Forestry

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VETERINARY MEDICINE

October, 1930

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No. 10
VOL. XXV

75 E. Wacker Drive
Chicago, U. S. A.

Service, Where and When It's Needed

A serious outbreak of hog cholera occurred in Southern Minnesota in August. Within a few days the St. Paul and Mankato branches of this Company were deluged with urgent orders for Fort Dodge Anti-Hog Cholera Serum from rushed practitioners.

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D. M. Campbell, Editor A. T. Kinsley, Associate Editor

The Eleventh International Veterinary Congress

"The greatest event in modern veterinary history," is the estimate placed upon the 11th International Veterinary Congress by the editor of the *Veterinary Record*. No one who attended the Congress will gainsay this statement or entertain a doubt of its accuracy. Personally, we would amend the statement by deleting the word "modern."

The Congress was "international" in every sense of the word. A complete record of the attendance is not available at this writing, but on the first day of the Congress, the registration exceeded 600 and more than 60 nations were represented. The membership of the Congress at that time exceeded 1,800, a record in the history of the Congresses.

A conception of the diversity of the program and the importance of the discussions can be gained from the extensive abstracts in this issue better than from any description, but this gives no idea of the excellence of the work of the organizing committee, what we would term the local committee on arrangements, in providing for the comfort, convenience, entertainment and instruction of those in attendance at the Congress. The work of this committee left little to be desired and was the subject of favorable comment from everyone in attendance.

The importance of the subjects discussed and the high quality of the discussions must be the justification for using practically all of the space in this issue of VETERINARY MEDICINE for abstracts of papers delivered at the Congress. A number of these papers will be published in full later, but it has seemed desirable to make available to American veterinarians, abstracts of those of greatest importance to the practitioners in this country at the earliest possible moment so that such new information as has been evolved by the leaders of the veterinary profession the world over, may be made available to all, without the months of delay that must occur before the discussions appear in full in veterinary publications.

The meeting was opened by the Rt. Hon. the Earl of Harewood in a most fitting and appropriate address, which incidentally revealed that Lord Harewood, a member of the Upper House of Parliament, is a strong supporter of the veterinary profession and is familiar with its achievements and possesses a broad understanding of its functions and capabilities.

The first business of the Congress after the opening address of Lord Harewood was the election of a president. To this office, Sir John McFadyean, known by reputation to every American veterinarian, was elected. In his opening address, he referred at some length to the history of the International Veterinary Congress. The first Congress was held in 1863 at Hamburg, Germany, on the call of Prof. John Gamgee. The second Congress was held at Vienna, Austria, in 1865, and the third in Zurich, Switzerland in 1867. Succeeding Congresses were held at Brussels, Belgium, in 1883, at Paris in 1889, at Berne, Switzerland, in 1895, at Baden Baden, Germany, in 1899. The eighth Congress was held at Budapest, Hungary, in 1905, and is notable because of the great increase in membership, 1,400, of whom 900 were foreign members. The ninth Congress was held at The Hague, Holland, and the tenth as most readers will remember, was to have been held in London in 1914, but was adjourned on the second day of the meeting because of the outbreak of the World War. On this account the eleventh, the present Congress, was held in London. It was decided to hold the next, the twelfth Congress, in the United States, in 1934. The Permanent Committee favored Boston as the meeting place, but there are better reasons for choosing Buffalo, N. Y.

Many courtesies were shown the visiting veterinarians by the City of London and by British veterinarians. In these the Americans did not fare badly and were particularly favored in honors allotted; the Royal College of Veterinary Surgeons having conferred upon the head of our delegation, Dr. John R. Mohler, the degree of honorary associate membership. So, to V. M. D., and D. Sc., Chief Mohler is now entitled to add M. R. C. V. S. In passing, it may be mentioned that H. R. H. the Prince of Wales heads the list of honorary associate Members of the Royal College of Veterinary Surgeons. Franz Hutyra, Josef Marek, M. Carré, V. Stang (of Berlin), V. A. Moore, and a number of others altogether about thirty, have the same degree.

The abstracts of the papers in this issue and those that will be published in the following issues of VETERINARY MEDICINE are indicative of the scope and quality of the discussions, but as a general summary, it might be mentioned:

Infectious Abortion

It appears the United States is more afflicted with infectious abortion in cattle than any other country in the world. Apparently vaccination with live organisms for the prevention of infectious abortion is less opposed in most countries in Europe than here. Considerable importance was ascribed to abortion not due to the *Br abortus,* such abortions some thought constituted one-third of all abortions occurring in cattle.

Hog Cholera

As it is generally understood, hog cholera is more prevalent in the United States than elsewhere. However, it is perhaps surprising to American veterinarians to learn that Germany contains approximately twice as many hogs as the state of Iowa and that hog cholera is widely distributed throughout the country and occasions great loss. An astonishing thing is, that German veterinarians appear to be but slightly acquainted with the serum-virus, simultaneous vaccination for the prevention of hog cholera and to rely to a considerable extent upon the use of horse serum and various sanitary measures, which are proving, as they must continue to prove, quite ineffectual in controlling the disease.

The German delegates seemed loath to admit the extent of hog cholera in their country and to charge no small proportion of their losses from the disease to swine erysipelas and other diseases.

The condition may be summed up by saying that they are now in the muddled state in reference to this disease and vaccination that American veterinarians were in 1913 to 1915. Other countries, no

doubt because of their small swine population, seem to suffer but small losses from hog cholera.

Bovine Mastitis

The discussion of bovine mastitis was illuminating in that it indicated that this disease is prevalent in every part of the world represented in the Congress and occasions enormous losses wherever intensive dairying is carried on.

Strangely enough, only one speaker, Prof. Steck of Switzerland, referred to the means of prevention so commonly resorted to by American veterinarians, that is frequent (three or four times daily) milking of heavy producing cows.

Milk Fever

The discussion of milk fever was interesting and fully supported the hypocalcemia theory of its cause. The subcutaneous injection of calcium gluconate is preferred to the intravenous injection of calcium chlorid. The use of calcium phosphate was held to be ineffective because the calcium in that preparation is not ionized.

Foot-and-Mouth Disease

Foot-and-mouth disease of cattle is a big problem over much of the civilized world and the discussion served as a reminder of the wisdom of our live stock sanitary forces in eradicating this disease whenever it has appeared in America, even though the drastic and expensive slaughter method of eradication is the only means to this end known at the present time.

Some progress, it appears, is being made in the control of this disease by the use of an immunizing serum and one speaker, Dr. José Lignieres of Buenos Aires, claims to have discovered a vaccine that is effective as an immunizing agent and offers a possibility for the control of the disease and its elimination at far less cost than the slaughter method. The Congress was frankly skeptical as to these statements and declined to recommend a committee to investigate Lignieres' vaccine, apparently agreeing with Sir John McFadyean that when if ever beneficial results are shown from the use of this vaccine in the Argentine will be soon enough to investigate it. Doctor Lignieres did not purpose to divulge his method of making the vaccine.

Tuberculosis

The discussion of tuberculosis was limited to a discussion of B. C. G. vaccine. French and Italian veterinarians unqualifiedly supported it. German and British veterinarians were in the main favorable to it. Veterinarians from Holland and Sweden were somewhat divided, but on the whole convinced that it possesses merit. Canadian and American veterinarians wanted none of it.

It would appear from the discussion that two strains of B. C. G. have been supplied research workers by Calmette and Guerin. The one distributed in 1928 was stated to be non-virulent by all who mentioned having received it. A strain distributed earlier was claimed by Watson and a number of others, to have developed virulence. While Doctor Guerin stated that the plan of tuberculosis eradication followed in the United States and Canada is "unnecessarily expensive," no one suggested a practical condition or even a hypothetical case where we could see it would be to our advantage to substitute for the highly successful method that is now employed, any other means suggested at the Congress.

Anthrax

Considerable attention was given to the dissemination of anthrax, often international, by the shipment of infected hides and other contaminated animal products. Suggestions for the control of this means of spread were embodied in a resolution.

Rinderpest-Trypanosomiasis

A number of diseases were discussed that do not occur in North America. Their interest to North American veterinarians is, of course, only indirect.

The relation of veterinary science to public health, laws governing the practice of veterinary medicine, and the reg-

ulation of the manufacture and distribution of biologic products were also discussed.

Rabies

The annual vaccination of dogs for the prevention of rabies was strongly supported by the experience of the delegates to the Congress, and it was rather surprising to hear delegates from the old world countries state that the difficulty of enforcing effective quarantine and muzzling measures was so great in their countries as to render this means of eradicating this disease impracticable. We had supposed that Americans were the only people that would willingly put up with the unnecessary, costly nuisance that rabies is, when means of its eradication were fully known and entirely practical. The attitude of dog owners toward restrictions on their pets, however, appears to be pretty much the same the world over. The achievement of Great Britain and the Scandinavian countries in eradicating this disease years ago and in keeping their territories free of it, stands out all the more strongly in contrast with the negligible measures that have been taken in this country and elsewhere.

Canine Distemper

Not much of anything that is new was brought out on this subject. The discussion was largely confined to the advantages and disadvantages of the Laidlaw-Dunkin vaccine with the majority strongly supporting it.

One speaker believed that the bacteria ordinarily present in cases of distemper are of equal, if not greater importance, than the filtrable virus and that they should be taken into consideration in any means for preventing the disease.

Nutritional Diseases

Perhaps for the first time in an International Veterinary Congress, nutritional ailments received much consideration. Not much if anything was brought out that has not already been published in veterinary literature.

The importance of nutritional deficiency as a cause of sterility was more strongly emphasized, however, than has been the case at American veterinary meetings.

Nutritional deficiency in cattle at pasture may occur even where the grass is luxuriant in the opinion of some of the investigators of this subject.

Poultry Diseases

A surprising amount of attention was paid to poultry diseases. The stand taken by several that the *B. gallinarum* (Klein), the cause of fowl typhoid and the *B. pullorum,* the cause of white diarrhea in chicks, are one and the same organism, will probably be news to most of our veterinarians.

The efficacy of the agglutination test as a means of diagnosing pullorum disease and the practicability of its control by this means, received fairly universal support; at least it was not questioned to the extent that it is in American veterinary meetings.

American veterinarians in attendance at the meeting, were:

F. M. Hays, G. H. Hart, C. B. Outhier and E. M. Dobbs of California; H. D. Bergman, C. H. Stange and J. O. F. Price, of Iowa; John R. Mohler, J. S. Buckley and Major J. D. Derrick of District of Columbia; W. E. Cotton of Maryland; F. R. Beaudette and Tom E. Smith, of New Jersey; H. M. McConnell, Hugh E. Curry, A. T. Kinsley and J. W. Connaway of Missouri; E. Sunderville, A. Eichhorn, E. B. Ackerman, H. K. Miller, John F. DeVine, F. L. Stein, E. L. Volgenau and Wm. Henry Kelly, of New York; A. F. Schalk and J. H. Lenfestey, of Ohio; C. J. Marshall, T. J. Schneider and E. L. Stubbs of Pennsylvania; Wm. Bell of Tennessee; D. M. Campbell of Illinois; E. A. Watson of Quebec, C. D. McGilvray and Geo. Hilton of Ontario, and perhaps others. As the ladies in the A. V. M. A. party touring Europe were also registered and some others not veterinarians, the total registration from the United States and Canada approached 100.

HALL PRESIDENT OF THE A. V. M. A.

Maurice C. Hall, Chief of the Zoological Division of the Bureau of Animal Industry, U. S. Department of Agriculture, was elected president of the A. V. M. A. for the ensuing year at the meeting in Los Angeles, August 24th to 29th.

Compared with the attendance at recent meetings of the A. V. M. A., the attendance at the Los Angeles meeting was small indeed, the total registration being about 600, of whom rather fewer than 400 were veterinarians. This is accounted for, of course, in the main, by the great distance from the center of veterinary population to the place of the meeting and perhaps also in part by the fact that a number of veterinarians who ordinarily contribute much to the success of meetings of the A. V. M. A. were in Europe at the time following attendance at the International Veterinary Congress at London.

The program, however, was fine and the entertainment provided for visitors by the California veterinarians, even better. The weather, as was to be expected, was hot, and also as was to be expected, the Native Sons said it was "very unusual."

It was decided to hold the next meeting of the A. V. M. A. at Kansas City.

Immunity depends upon a number of factors. One of these is potent serum and virus, another is proper dosage but neither is sufficient to insure immunity unless other equally important factors are given full consideration. Swine may be injected with proper amounts of thoroughly potent serum and virus, yet fail to become immune. Why? Because some of the other factors upon which real immunity depends are absent or because certain conditions which exist in the herd or in individual animals destroy the possibility of the animals becoming immune. —E. A. Cahill.

The importation of santonin into the U. S. has increased 200% during the past year.

Abstracts*

The Use of Drugs in the Treatment of Diseases Caused by Nematode Worms[1]

A BALD statement of drugs, doses, purgatives, modes of administration, and contra-indications alone will not necessarily convey all the information required for the successful use of anthelmintics. It is imperative that the person administering the drugs have a broad background of education and experience and that he have the sound judgment and ability requisite for putting together the factors of patient and drug with the desired result in the form of destruction of parasites without serious injury to the patient.

It must be admitted at the outset that students in the veterinary colleges of the world receive inadequate instruction and training in the use of anthelmintics, that textbooks are quite generally out of date in their discussions of these drugs, and that the veterinarian must either familiarize himself with the publications scattered in several languages through the world's literature, or learn by costly experience just how to handle the potent and dangerous drugs which make up our anthelmintics.

All that can be given here is a résumé of the treatments actually used for the destruction of nematodes. The application of these treatments calls for a knowledge of therapeutics and parasitology. Ignorance along these lines may lead to disaster with any treatments.

The term *critical test* in this paper refers to testing by administering anthelmintics, collecting all worms passed for a sufficient period of time, varying with different species of host animals, identifying and counting the worms passed, killing the animal at the close of the experiment, and identifying and

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* From the Official Report of the 11th International Veterinary Congress, August 4-9, London, England, 1930.

[1] The Use of Drugs in the Treatment of Diseases caused by Nematode and Trematode Worms; by Maurice C. Hall, Ph.D., D.Sc., D.V.M.; Chief, Zoological Division, Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C. Presented at the Eleventh International Veterinary Congress, London, 1930.

counting all worms present post-mortem. The figures obtained in this way give accurate information as to the value of a drug.

NEMATODE OF SOLIPEDS

All doses are for animals weighing 1,000 pounds (455 kilos).

Ascarids: Carbon bisulphid in capsules; 6 fluid drams (25cc) in capsule; no purgative, as carbon bisulphid is amply purgative and additional drugs may cause superpurgation; worms pass for several days; carbon bisulphid produces rather regularly an inflamed area about the size of a man's hand in the stomach below the aperture of the esophagus, and is probably contra-indicated in cases of gastritis.

As alternative treatment when carbon bisulphid is contra-indicated: Carbon tetrachlorid in capsules or by stomach tube: 6 to 12 fluid drams (25 to 50cc); usually safe without purgative, but probably safer if given with salts; worms pass for several days; damaged liver or low blood-calcium a contra-indication.

Large strongyles, palisade worms, or *red worms of large intestine* (*Strongylus* spp.): Oil of chenopodium in capsule; 4 to 5 fluid drams (16 to 20cc); precede the chenopodium immediately by one quart (1 litre) of raw linseed oil, or follow with an aloes or aloin ball; worms pass for six days or longer; contra-indicated in cases of gastroenteritis and, possibly, of pregnancy, although it has been used without bad results in many cases of pregnancy.

As alternative treatment when chenopodium is contra-indicated: Carbon tetrachlorid as for ascarids.

Cylicostomes: Chenopodium as for large strongyles.

As alternative treatment: Carbon tetrachlorid, though this is less effective than chenopodium.

Pinworms or oxyurids: Oil of chenopodium as for large strongyles.

As alternative treatment: Oil of turpentine; two fluid ounces (60cc); raw linseed oil or aloes or aloin ball as for chenopodium; contra-indicated with certain kidney derangements.

Stomach worms: Carbon bisulphid, carbon tetrachlorid or tetrachorethylene are indicated for further test. It is difficult to obtain precise information as to the value of drugs for removing these worms because of the fact that the worms are digested in the stomach after being killed. Preliminary gastric lavage with the stomach tube is indicated to remove the mucus which protects these worms from anthelmintic attack.

For nematode worms in general, horses may be given a treatment with carbon bisulphid, followed two weeks later by a treatment with oil of chenopodium. An alternative procedure is to give one treatment with carbon tetrachlorid.

NEMATODES OF CATTLE

Treatments for removing nematodes from cattle are not yet well established and little of a definite sort can be recommended at this time.

Stomach worms (*Hemonchus* spp.): Copper sulphate solution, 1%, or the same to which has been added a 40% solution of nicotin sulphate solution at the rate of one fluid ounce (30cc) to a gallon (3.8 litres) of the copper sulphate solution, given as drench or by tube; one quart (1 litre) for adult animals; no purgative necessary as a rule.

Alternative treatments: Carbon tetrachlorid in capsule or by stomach tube; one fluid ounce (30cc); salts as purgative; decidedly contra-indicated in milking animals and possibly in animals on high feed. Tetrachlorethylene by tube; 1 to 2 fluid ounces (30 to 60cc); no purgative necessary as a rule, but salts advisable.

Ascarids: No treatment established by critical tests; turpentine, 2 to 4 fluid drams (8 to 16cc), in castor oil, two ounces (60cc), has been recommended. Oil of chenopodium, carbon tetrachlorid and tetrachlorethylene should be tested.

Hookworms: No treatment established by critical test. The copper sulphate and nicotin sulphate solution should be tested. Tests with tetrachlorethylene in doses of one fluid ounce (30cc) for calves removes some of the worms, but not as many as should be removed to make this a dependable treatment.

Small trichostrongyles (*Ostertagia* spp., *Cooperia* spp., *Nematodirus* spp., *Trichostrongylus* spp.): No treatment established by critical test; carbon, tetrachlorid and tetrachlorethylene indicated for test.

Nodular worms (*Esophagostomum radiatum*): No treatment established by critical test; carbon tetrachlorid or tetrachlorethylene would probably remove some of the worms; shoud be given with salts to carry the drug to the large intestine.

Nematodes of Sheep and Goats

Stomach worms (*Hemonchus contortus*): Copper sulphate solution, or copper sulphate and nicotin sulphate solution as for stomach worms in cattle; 3½ fluid ounces (100cc) for adult sheep; no purgative needed.

As alternative treatment: Carbon tetrachlorid or tetrachlorethylene; 5cc in capsule; dry sodium sulphate to fill a capsule of 5cc capacity, with or immediately following the anthelmintic.

Any of the four treatments indicated above may be given as often as every two weeks throughout the year without injury to sheep; all except the carbon tetrachlorid treatment can be given as often as once a week. Animals on pasture may need to be treated as seldom as two or three times a year in some areas, and as often as once every two weeks in other areas.

Hookworms: The same as for stomach worms, except that the copper sulphate solution alone is not very effective in the removal of hookworms.

Small trichostrongyles (*Ostertagia, Cooperia, Nematodirus, Trichostrongylus*): Carbon tetrachlorid or tetrachlorethylene, as for stomach worms; the efficacy of these drugs against these worms is variable. We have no drugs that can be depended upon to remove these worms with any certainty, as the worms are very small and commonly embedded in mucus or in the mucosa, and hence inaccessible to our drugs.

Nematodes of Swine

Ascarids: Oil of chenopodium; 2 to 4cc for 100-pound (45-kilo) pig, the larger dose the more effective, the smaller the safer for routine use; castor oil, at least two ounces (60cc) in capsule, immediately preceding the drug, or as a vehicle for the chenopodium, in which case treatment may be administered by drench or stomach tube. It should be kept in mind that swine are difficult to purge and that adequate doses of purgatives must be used.

Stomach worms (*Arduenna strongylina, Physocephalus sexalatus, Hyostrongylus rubidus*): Oil of chenopodium as for ascarids. This treatment will probably destroy worms which are accessible, but not those embedded in mucus or the mucosa. The efficacy of treatment is not easily ascertained because of the digestion of dead worms.

Nodular worms (*Esophagostomum* spp.): No treatment established.

Trichina: No treatment established.

Nematodes of Dogs

Ascarids: Oil of chenopodium; 0.1cc per kilo of weight of dog; precede the drug with castor oil, one fluid ounce (30cc); worms may pass for seven days; distemper, severe cases of mange, and gastro-enteritis are contra-indications for chenopodium, and the dose must be diminished for pups; to pups 1 to 3 minims may be given with an ounce of castor oil with good results.

Alternative treatments: Carbon tetrachlorid; 3cc in capsule to 22-pound (10-kilo) dog, a dose-rate of 0.3cc per kilo; dry sodium sulphate in capsule of 2cc capacity, with access to water, is advisable; distemper and severe mange are contra-indications. Tetrachlorethylene; 2cc in capsule to 22-pound (10-kilo) dog, a dose-rate of 0.2cc per kilo; dry sodium sulphate in capsule of 2cc capacity, with access to water, is advisable; distemper and severe mange are contra-indications. Santonin; one grain (0.06 gm.) with equal amount of calomel daily for 22-pound (10-kilo) dog, for 7 to 10 days.

Hookworms: Carbon tetrachlorid or tetrachlorethylene as for ascarids; purgative apparently not necessary in absence of ascarids; tetrachlorethylene safer than carbon tetrachlorid and especially indicated for pups; contra-indications as for these drugs in ascariasis.

Whipworms: Santonin in small daily doses according to size of dog daily for 7 to 10 days, the treatment repeated, beginning a week later, if necessary.

NEMATODES OF CATS

Ascarids: Oil of chenopodium; 1 to 3 minims; precede immediately by an ounce (30cc) of castor oil.

Hookworms: Tetrachlorethylene, 0.2cc per kilo; purgative of choice not established, and none necessary as a rule.

NEMATODES OF CHICKENS

The large roundworm of the small intestine (*Ascaridia* spp.): Oil of chenopodium, 0.3cc, in castor oil, 3cc.

Alternative treatments: Carbon tetrachlorid or tetrachlorethylene; 2cc for 3-pound bird; no purgative needed.

Cecum worm or heterakid: Rectal injections of 0.1cc of oil of chenopodium in 5cc of a bland oil, such as cottonseed oil.

Capillarids (*Capillaria* spp.): Carbon tetrachlorid or tetrachlorethylene; 2 to 5cc. These treatments will destroy some capillarids, presumably those reached by the drugs. They will not destroy worms out of reach in mucus or embedded in the mucosa.

LUNGWORMS, FILARIDS, SPIRURIDS, ETC.

Up to the present time we do not appear to have a medicinal treatment well established as of value for the destruction of lungworms. There is little evidence indicating that the treatments advocated actually do kill lungworms, and much evidence indicating that many of the drugs used injure the patient. Such worms as species of *Synthetocaulus* will obviously be difficult to reach with drugs administered intratracheally or by inhalation. Nursing treatment, the removal of the animals from infested areas, the provision of well-selected, nourishing food and safe drinking water, with access to salt, appears to be the best line of treatment, and animals generally recover from the effects of clinical lungworm disease in the course of a month or two under such treatment.

In the case of the gapeworm of chickens, mechanical extraction apears to be the only established treatment, and prophylaxis is the essential thing.

Treatments for the destruction of various filarids occurring in the circulation, subcutaneous tissues, etc., have not been developed in veterinary medicine, and very little has even been attempted, although considerable work along this line has been done in human medicine; we are neglecting this field. Much the same is true of treatments for the spirurids occurring in various tissues, including those in the tissues of the digestive tract. The same is true for such worms as *Dioctophyme renale.*

The Treatment of Diseases Caused by Nematode and Trematode Worms[2]

Recent advance in the use of anthelmintics is largely due to improved methods of testing their action. The best procedure is that in which the test animal is killed after treatment in order to compare the number of worms left behind, with the number of those which have been expelled. Exact data so obtained has made possible the selection of the few useful drugs from the host of indifferent ones with which they were formerly confused.

Pharmacological actions on animal tissue in general are still unexplained, and attempts to explain the basic principle of anthelmintic action have so far failed. The association of efficiency with some part of the molecular structure of drugs already known to have anthelmintic properties is, however, a useful key to the investigation of allied substances, and has already led to the discovery of some valuable drugs.

Knowledge of the species of worm present should be obtained before treatment is prescribed, as the action of anthelmintics is more or less specific. Some idea of the extent of the infestation should also be obtained, as it is advisable not to give these poisonous drugs unless the infestation warrants it.

[2] The Use of Drugs in the Treatment of Diseases Caused by Nematode and Trematode Worms; by E. Leonard Taylor, B.V.Sc., M.R.C.V.S., D.V.H.; Veterinary Laboratory, Ministry of Agriculture and Fisheries, Weybridge, England. Presented at the Eleventh International Veterinary Congress, London, 1930.

The action of anthelmintics is sometimes modified by anatomical peculiarities of the intestine of the species of host animal. With the exception of equines, the ceca of domestic animals have only one opening and only a small proportion of the anthelmintic enters. The stomach and small intestine of the horse are relatively of such small size that anthelmintics hurry through and have not time to exert their action. Other features of importance are the four stomachs of ruminants, the voluminous proportions of the large intestine of the horse and the relative length of the small intestine of herbivores in general.

Castor oil, magnesium sulphate or calomel are the best purgatives to accompany an anthelmintic dose, as they protect against its toxic action. Liquid paraffin and olive oil, on the other hand, tend to increase absorption. Purgation should always follow anthelmintic treatment as soon as possible.

The following treatments are efficient:

Oil of chenopodium for ascarids of dog, cat and pig, and for red worms of the horse.

Carbon bi-sulphid and carbon tetrachlorid for the ascaris of the horse.

Carbon tetrachlorid for the liver fluke in sheep, for the hookworm in dogs and sheep, for intestinal trematodes in dogs, and for *Hemonchus* in sheep.

Tetrachlorethylene for ascarids and hookworms in cats, dogs, and foxes.

Copper sulphate for *Hemonchus* in sheep.

Extract of male fern for liver fluke in sheep.

Tetrachlorethylene is probably the best drug for the hookworm in cats and pigs.

Tartar emetic has a powerful action on blood flukes in sheep.

Some of the important parasites for which no satisfactory treatment has yet been found are as follows: Lungworms in general, parasites of muscle and connective tissue in general, liver fluke in cattle, nodular-worms in sheep, *Onchocerca* in cattle, and the smaller trichostrongyles of the stomach and small intestine of sheep and cattle.

The Treatment of Parasitic Diseases[3]

The author deals with certain intestinal parasites of poultry in Holland. They belong principally to the genera Davainea, Heterakis, and Capillaria.

Attention is drawn to the frequent occurrence of paralysis, without it being possible to demonstrate the presence of *Davainea proglottina;* it is doubtful whether this parasite is actually the cause of the paralysis.

From the investigations of Marek, van der Walle and Winkler Junius, Pappenheimer, Dunne and Cone, it is known that a filterable virus is capable of causing paralysis. It is not definitely known whether, in cases in which tæniæ are found and symptoms of paralysis are also present, the parasites play any part in the production of those symptoms. The work of Bayon, who investigated the connection between leukemia (erythromyelosis) in poultry and *Davainea proglottina,* requires confirmation by further research. The majority of drugs ordinarily used against the tæniæ, and certain nematodes (Heterakis and Capillaria) are passed under review. Among these may be mentioned kamala, nicotin sulphate, tetrachlorethylene, oil of chenopodium, oil of turpentine, and calomel.

It has been found that kamala, after repeated administrations, is not effective for the expulsion of tæniæ. The other drugs were no more effective for the removal of Capillaria and Heterakis.

Good results were obtained from the cloacal injection of oil of chenopodium. By this means *Heterakis vesicularis* can be removed completely.

Intestinal parasites have a specially injurious action during the first four or five months of life. Animals older than this become more or less resistant; it is difficult or impossible to infect them.

As the action of the majority of the drugs is insufficient, one cannot obtain the result which might be expected from a long, difficult, and expensive treatment.

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[3] Traitement des Maladies Parasitaires; by Dr. E. A. R. F. Baudet, Parasitologue à l'Institut des Maladies parasitaires et infectieuses à l'Université d'Utrecht, Netherlands. Presented at the Eleventh International Veterinary Congress, London, 1930.

The campaign against intestinal diseases of parasitic origin should therefore be based upon prevention. As in the case of the contagious diseases it may be admitted that, apart from the presence of the parasites, there must be a condition of predisposition, in order that parasitic infections may develop. It may also be admitted that this predisposition is increased by unfavorable circumstances. In the first place one should concentrate upon protective measures for the young birds. We will indicate only the necessity of dry fowl-houses and runs and the importance of using wire-netting enclosures to prevent the spread of contagion; birds should be prevented from gaining access to the edges of ditches and marshes (pure water should be given).

The new method of poultry raising, in which the birds are kept constantly indoors, and large numbers are kept together in a small space, is being adopted more and more extensively.

The campaign against intestinal parasites is facilitated by this method.

The Treatment of Parasitic Diseases of Poultry[4]

It may be concluded—

1. That we possess satisfactory means for controlling ectoparasites. These seldom cause fatal conditions. In the majority of cases they produce fatal conditions in either young birds or in adults which are affected with some other serious disease. Extreme caution must be exercised in attributing any action to ectoparasites which are sometimes found in considerable numbers on carcases.

2. The same does not hold good for endoparasites. Thus

(*a*) We possess no drug which is capable of expelling with rapidity and certainty the Capillaria;

(*b*) Tobacco is the best material for attacking Heterakis, but it should be given for at least thirty days;

(*c*) The evolution and habits of the genus Tetramerus are not well known;

(*d*) We know of no medicament which can be utilized efficaciously against the Trichostrongylinæ;

(*e*) We know of no means for the effective and practical destruction of the intermediate hosts of the cestodes and certain Trematodes;

(*f*) The causal agent of entero-hepatitis of turkeys (blackhead) is not recognized by all authors;

(*g*) The intestinal reaction which is most favorable to the development of coccidia should be studied in the hope that it might lead to the discovery of drugs which would alter that reaction and render it unsuitable for this parasite;

(*h*) We have no knowledge of the means which may be used for checking monostomiasis;

(*i*) The same is true for the prevention and cure of salpingo-ovaritis caused by Prosthogonimus.

Tests of the Anthelmintic Action of Certain Drugs on Nematode Worms in Animals[5]

Experiments with certain anthelmintics carried out on some 400 animals allow the following conclusions to be drawn:

1. Santonin and its derivatives are specific anthelmintics for ascarides, and the therapeutic doses are much smaller than the lethal doses.

2. The dosage of Santonin for dogs, cats, and pigs requires revision in the sense of increasing the doses.

3. The efficiency of Santonin depends less upon the dose than upon the laxative given with it and the manner in which it is given.

4. Santonin is least effective against the ascarids of horses, but this drug removes a considerable proportion of the strongyles.

5. Carbon tetrachlorid is to be considered as the most effective anthelmintic against the equine strongyles.

[4] Traitement des Maladies Parasitaires des Volailles; by Dr. J. Lahaye; agrégé à l'Ecole de Médecine vétérinaire de Bruxelles, Belgium. Presented at the Eleventh International Veterinary Congress, London, 1930.

[5] Prüfung das. anthelmintischen Wirksamkeit einiger Wurmmittel gegen Nematoden der Tiere; by Dr. R. Ed. Schulz; Chef des Helminthologischen Institutes, Moskau, U.S.S.R. Presented at the Eleventh International Veterinary Congress, London, 1930.

The Scientific Principles of Nutrition[6]

At the California Experiment Station we have been studying the percentage calf crop in range herds for the past three years. Economic studies have shown this to be one of the most important factors in the cost of production of beef cattle. In our abortion studies we, as well as others, have shown infectious abortion to be self-limiting, particularly in range cattle, and while very serious during one or two years on individual beef cattle ranches, was not the important factor in percentage calf crop year after year over wide areas. Emmerich and Loew, Tuff, Eckles, et al., Evans and Bishop, and others have shown definitely that nutrition plays a part in reproduction and that the normal functioning of the ovary can be influenced by qualitative and quantitative under-nutrition.

We have been impressed by the very extreme degree of under-nutrition to which range cattle may be subjected in semi-arid areas during parts of practically every year. Walker and Lantow showed that 78 per cent of losses in New Mexico were due to this cause, which means that 12 out of every hundred head of cattle on ranches in that state die of starvation.

Not many years ago it was common during short feed years for the labor supply on some cattle ranches in California to be utilized principally in taking the hides off cattle which had died of starvation. Such poor feed conditions would be followed by short calf crops. The number of calves per hundred cows shows extreme variations in southwestern United States. In Nevada, Arizona and California, statistics gathered by Hilts, Stanley, and Adams show a variation from 25 to 95 per cent, with an approximate average in Arizona of 40 per cent over a period of years.

At the present time, with increased costs of operation and satisfactory market values of slaughter cattle, great interest exists in more knowledge regarding the proper use of the natural vegetation and efficient supplementing of it with nutrients that will most efficiently produce animals of slaughter quality in the shortest period of time and maintain the breeding herd at a high stage of reproductive ability.

The problem, which is one of great possibilities, therefore, involves a study of the range grasses and browse at various seasons of the year to ascertain their chemical compositions. Indirectly, the amount and availability of the plant food ingredients in the soil are involved.

In the large central valley with mountains on either side in California, where our studies are being made, the range grasses are almost entirely annuals. The grass, which is green in the winter on the lower levels, matures with seed shattering in May or June, and the plants dry on the ground, after which they are subject to leaching if late rains occur and bleaching during the remainder of the dry season until late fall or winter, when rains again start the green feed. In the area it has long been known that the flora, as well as the feed value of the vegetation, varies in different localities, depending on soil types.

We have so-called bald areas with adobe soil, which are entirely without trees, wooded areas with gravelly soil which are quite sparsely covered with trees or brush, slate areas and granite areas. The latter two both have some tree growth. The bald areas produce the best feed and are good fattening areas, while the granite areas probably produce the poorest quality of feed.

In the late summer and fall cattle will hold their own on bald areas by licking clover burs and alfilaria seed off the ground, even though the land appears perfectly bare, while on granite areas they will lose weight and reach an advanced degree of under-nutrition on vegetation that is half-way up to their knees. Chemical analyses and digestion trials show the latter feed to be low or entirely lacking in available protein and low in minerals, with generally a high calcium, low phosphorus ratio. The actual intake of phosphorus is too low in some localities to prevent craving, so that mild

[6] The Scientific Principles of Nutrition, with Particular Reference to Percentage Calf Crop in Range Herds; by George H. Hart, V.M.D., M.D., Professor of Animal Husbandry, College of Agriculture, University of California, Berkeley, Calif. Presented at the Eleventh International Veterinary Congress, London, 1930.

bone chewing and soil eating become evident.

We have carried on feeding experiments with white rats to study the effect of changing dietary regimens on the regularity of the estrus cycle. This work is being continued, but evidence has already accumulated that under-nutrition stops the cycle, and low protein and low phosphorus intake tends to stop or at least greatly lengthen it, as does also a wide calcium phosphorus ratio. This supports observations on the range. When non-pregnant cows get very thin, no estrum is noticed until conditions are such that the animals begin to improve physically, even though months are required for this change to occur. In bringing about this change with supplemental feeds, one must consider all of the varied differences between dry range grass which has matured, and green, closely-cropped pastures.

In parts of the area very good results are being secured at present with cotton-seed cake, which is rich in protein, phosphorus and fat. Bone meal is being used somewhat, but cannot be expected to meet anything but a mineral deficiency. The special handling of cotton-seed cake as a supplement to increase percentage calf crop and general nutrition of the herd has been outlined by Crews, a range cattleman in Texas. He showed it to be much more economical to feed 350 pounds than 100 pounds per head per annum. When his pregnant cows were fed 2 pounds per day for 30 days before and after calving, 50 per cent of the fresh cows came in heat during the 30 days following parturition and were re-bred.

Cutting the range grass while green and leaving in the swath, windrow or shock has been found preferable to leaving it to mature standing with resulting seed shattering. Analysis shows the cut material is higher in protein and phosphorus.

A great deal more work will have to be done to piece together the disconnected shreds of knowledge now available regarding this matter, and new links will have to be added before the chain is complete.

We nevertheless believe that sufficient evidence is at hand to state definitely that in a knowledge of the scientific principles of nutrition lies the solution of one of the most important factors in the present variable percentage calf crop in range herds. Even though the application of this knowledge when available may require considerable expense and changes in methods, we are convinced that returns will justify the procedure.

Deficiency Diseases[7]

Deficiency diseases occur spontaneously in domesticated animals, especially in winter, and as a result of stall feeding. Failures of harvest and years of scarcity are also responsible. They owe their origin to a lack of vitamins, which are present in the energy-producing fractions of various organic foodstuffs and which, although present in extremely small amounts, exert a marked specific biological effect. They are necessary for the maintenance of life and well-being.

At the present time five different groups of vitamins are well recognized:

1. The anti-xerophthalmic or keratomalacia-preventing vitamin A.
2. The anti-neuritic vitamin B, which comprises at least two factors, the anti-neuritic factor itself and the maintenance and growth factor. The pellagra-preventing factor appears to be identical with the latter.
3. The anti-scorbutic vitamin C.
4. The anti-rachitic vitamin D.
5. The anti-sterility or reproductive vitamin E.

It is desirable that there should be agreement regarding the nomenclature and classification of the vitamins.

In order to avoid practical difficulties resulting from excessive importance being attached to the action of vitamins, attention should be paid in diseases of metabolism and many blood diseases not only to the vitamin-content of the food, but also the albumen-

[7] Mangelkrankheiten; by Prof. Dr. Josef Marek and Prof. Dr. Oskar Wellmann; Kgl. Ung. Tierärztliche Hochschule, Budapest, Hungary. Presented at the Eleventh International Veterinary Congress, London, 1930.

content (absolute quantity and its biological value), the carbohydrates and minerals (quantity and proportions), and also to the condition of the animals.

A sharp distinction between the deficiency diseases and between these and other diseases of metabolism can be expected only when the various vitamins have been recovered in a state of purity.

In view of the variation in the vitamin-content of different food materials, deficiency diseases are prevented with the greatest certainty by making the greatest possible change in the diet.

Diseases due to a deficiency of vitamin A appear to be of rare occurrence in domesticated animals. Diphtheria or the group of diseases resembling enzootic coryza of birds are considered to be examples (nutrition diphtheria or nutritional roup).

It remains for research to show whether the disease known as chronic marasmus is in many cases due to a deficiency of vitamin A or B.

A deficiency disease due to B-avitaminosis is observed more frequently in poultry, polyneuritis gallinarum, and this closely resembles beriberi of the human being. Acute beriberi-like diseases have been observed in dogs and rabbits.

C-avitaminosis produces scurvy, the clinical symptoms of which depend to some extent upon the species and age of the animal, but a rarefying fibrous osteitis with the appearance of the so-called "radiated marrow," and degeneration or even necrosis of the internal organs may be found in any case. Careful histological examinations of the bones and internal organs, and examinations of the blood will show whether the so-called scurvy of pigs has really anything to do with scurvy, and further, whether the diseases known as purpura, primary edema, and "licking disease" are due to deficiency of vitamin C.

Rickets and osteomalacia are not essentially due to a lack of vitamin D, but only under certain conditions. A far more important part is played in their etiology by deficiency of calcium and phosphoric acid.

In the absence of vitamin D an optimal provision of calcium and phosphorus is required, but on the other hand vitamin D may be ineffectual if the supply of mineral elements is specially poor.

Histologically rickets in animals corresponds with late rickets in man. The differences between this condition and ordinary infantile rickets lie in the more advanced stage of bone development at the time the disease appears in the animals and the far greater mechanical involvement of the skeleton. These differences, particularly the ordinary fibrosis of the bone marrow, the excessive exaggerated formation and osteoclastic resorption of the bone tissue, are characteristic of animal rickets and do not authorize their separation from true rickets and their classification as fibrous osteitis.

The nature of the diseases of animals known as rickets, osteomalacia, and osteoporosis can be determined only by a thorough histological examination of such future cases.

Uncomplicated cases of rickets and osteomalacia may recover, and their occurrence can be prevented by provision of sufficient calcium and phosphoric acid, by the administration of vitamin D, or by its production within the body by the use of ultraviolet light upon its precursor.

Infectious Abortion of Cattle, Swine and Sheep in the United States[8]

1. Greatly increased interest in infectious abortion has been stimulated in the United States by the spread of the malady to nearly every section of the country and the discovery that the disease has a significance for human health.

2. Means of diagnosis are worthy of intensive study, and this is recommended. While the agglutination test, the most satisfactory one now in use, is reasonably accurate, it has not been sufficiently standardized, nor does it give information enough to be entirely satisfactory for regulatory work.

3. While the disease may be economically

[8] Infectious Abortion of Cattle, Swine and Sheep in the United States; by Dr. W. E. Cotton, Superintendent of Experiment Station, U. S. Department of Agriculture, Bureau of Animal Industry, Bethesda, Md. Presented at the Eleventh International Veterinary Congress, London, 1930.

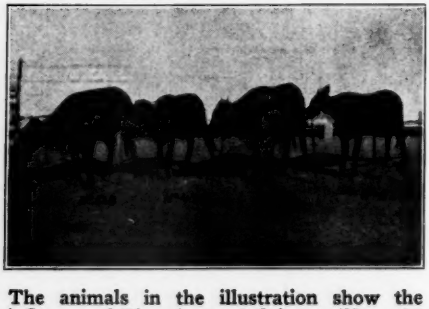
eradicated from many herds by the elimination or segregation of reactors, it is doubtful whether these methods are practicable in the majority. In these, less drastic but slower methods promise to be successful. It is recommended that the several methods of control receive exhaustive field trials under widely different conditions to determine their practicability.

4. Vaccine probably has a limited place in abortion control, but its production, distribution, and use should be under rigid supervision. There is a possibility that a fairly effective avirulent vaccine may be developed which is free from the objectionable featurs that attend the virulent.

5. It has been shown that cattle may be infected by the way of the conjunctiva and also probably through the unbroken skin. Further studies to determine the comparative importance of these routes and that of the digestive tract in both cattle and hogs are highly desirable and are recommended.

6. The relation of swine abortion to that of the bovine species should be more definitely determined, particularly in connection with the ability of the causal agent of the former to invade and to maintain itself in the udders of cows.

7. The question of human infection with *B. abortus* is of great importance because so many people are being exposed daily, both by contact with infected animals and through the consumption of milk containing this micro-organism. The sources of human infection and the possibility that the *Br. melitensis* may invade the udders of cows and thus become a greater menace to human health deserves study.



The animals in the illustration show the influence of Phosphorus deficiency (Nos. 475 and 528) on the growth of cattle. All were grazed on pasturage deficient in phosphorus, but Nos. 518 and 502 received in addition bone meal and made nearly 50% greater growth than the others.

Infectious Abortion of Cattle, Sheep and Swine[9]

If we first of all turn to infectious abortion in cattle, we find that this disease as a rule is caused by the *Bacillus abortus* Bang. Abortion can also be produced there by vibrio fetus, *Bacillus pyogenes,* tubercule bacilli, mold (mucor species and *Aspergillus fumigatus*), and paratyphus and paracoli bacilli.

According to C. O. Jensen, in a herd with infectious abortion, 16 per cent to 20 per cent of the cases may be produced by other causes than *Bacillus abortus* Bang; and with sporadic abortion, 42 per cent to 45 per cent may be so produced. Theobald Smith, who undertook very careful examinations of 109 cases of abortion in the same herd, reports that in 62 cases abortion bacilli were found, in 26 cases vibrio fetus, and in two cases the bacillus pyogenes, whilst 19 times it was not possible to find specific bacilli as a cause of the disease.

During the period 1912-1929 blood and other material have been tested at this Institute from a total of 16,743 cows which had aborted. Of these, 4,511 gave distinctly positive reactions and 297 suspicious reactions for infectious abortion, in all 28.72 per cent. The cows in question were distributed amongst a total of 12,905 herds, of which 3,659 (28.35 per cent) were found to be infected or were suspected. The number of cases of sporadic abortion which were not produced by specific abortion bacilli thus becomes relatively large, in that infectious abortion is not spread regularly over the whole country, the majority of cases occurring in definite districts.

Both in the uterine exudate and in the regions attacked by inflammation we find abortion bacilli in very large numbers. After

[9] Infectious Abortion in Cattle, Sheep and Swine; by Prof. H. Holth, Director of the State Veterinary Institute, Oslo, Norway. Presented at the Eleventh International Veterinary Congress, London, 1930.

abortion or calving has taken place, however, the mucous membrane cleanses itself comparatively quickly. Thus Schroeder and Cotton found virulent abortion bacilli in the uterus in such cases up to 50 and in some cases up to 65 days after calving, and practically speaking we can reckon that about two months after abortion the mucous membrane of the uterus will be free from bacilli. This period can be considerably reduced by systematic rinsing of the uterus with suitable antiseptic solutions.

Another part of the organism where abortion bacilli are often found is the udder and milk, and the investigations of recent years appear to indicate that a large majority of infected animals after abortion or calving secrete varying quantities of bacilli with the milk for a long time. In the case of some animals this condition ceases comparatively soon, but many become chronic carriers. Thus Schroeder and Cotton found that one cow secreted abortion bacilli with its milk no less than seven years after abortion had taken place.

Secretion of abortion bacilli with milk can also take place without the uterus being infected (Theobald Smith); bacilli may be absorbed from the alimentary canal or infection may take place in some other way, with the result that the udder alone becomes infected. Since the infected cows so frequently secrete abortion bacilli with milk, it is reasonable to suppose that milk sold from those districts in which the infectious abortion is prevalent is constantly infected, and a large number of investigations have proved that such is the case. In this connection it is not only the extent of the infection which plays an important part but also the size of the dairies, and to illustrate this I will give the results of a number of injections of guinea-pigs with milk from such sources.

(1) Collected tests from various farms.—68 samples examined. Abortion bacilli found in 7.

Collected samples taken at dairies from two to three farms.—173 samples examined. Abortion bacilli found in 37.

Collective samples from a large dairy company.—10 samples investigated. Abortion bacilli found in 0.

Shop milk from large dairy concerns in Oslo.—106 samples investigated. Abortion bacilli found in 1.

To prove the existence of abortion bacilli in milk, reference has, as yet, been made only to injection of guinea-pigs, but this method, as I shall subsequently show, is uncertain, and the figures reported do not give a reliable impression of the frequency of the excretion of these bacilli. It is conceivable that bacilli may occur in the gall and urine of infected animals, but concerning this we lack sufficiently comprehensive investigations. Mention may be made in this connection, however, of the fact that Carpenter found living bacilli in the spleen and other organs 251 days after a cow had been infected with abortion bacilli, and O. Bang and Bendixen in a similar experiment found bacilli in the lowest sheath of a tendon.

In the aborted fetus there will as a rule be found quite considerable quantities of abortion bacilli, both on the surface and in the intestinal canal. If abortion takes place so late that the calves are capable of living, they will harbor abortion bacilli in the intestines for a long time, but it appears as if it is difficult for the latter to multiply, and they are therefore quickly conquered by the usual inhabitants of the intestines.

Infectious abortion occurs principally amongst cattle and appears to be found in most parts of the world where cattle are reared to any great extent. It is also observed in certain countries and districts comparatively often amongst swine, quite exceptionally amongst sheep, goats and horses, and from the experiences of recent years appears to be of some importance as regards poultry. As regards infectious abortion amongst swine, it appears to be of less frequent occurrence in European countries than in the United States, from which in recent years there have been reports of relatively large outbreaks. One peculiarity of the infection amongst swine is that on an average it appears to depend upon bacilli

of considerably greater virulence than those bacilli which are generally found in cattle, and also that they relatively often appear to be transferred to human beings.

Norway was probably the first country to proceed to public measures against the disease, in that by Royal Resolution of June 22nd, 1903, it was included in the common infectious diseases of domestic animals, for which there is obligation to notify, prohibition against taking infected animals to markets, cattle shows, strange pastures, etc., and concerning which the public authorities can, if considered necessary, issue special regulations. This measure was, however, during the first years of no great importance, since at that time we had no diagnostic methods of deciding in a convenient way whether infectious abortion occurred or not, and as cases of sporadic abortion are comparatively common, it would be necessary to have many cases before there were sufficient reasons for interference, and in the meantime the disease would have had time to spread. After the diagnostic investigations of blood had been brought into use a considerable improvement has occurred in this respect, and the great advance of the disease has been checked, although of course there are still many new infections each year. One important obstacle to the decree being as effective as might be desirable is the fact that during the pasture season at many places there occurs infection in spite of the efforts of the owners. Interest in the disease and its prevention, however, is constantly on the increase.

As regards the direct campaign against abortion in any one herd, there can in my opinion be given no general rules, although certain main lines can be drawn, in accordance with which the necessary work should be conducted. Thus from my experience, after a fresh outbreak in a herd, there is often little to be done as long as the infection occurs more severely, since it can never be decided beforehand what the course of the disease will take, and we must therefore as a rule await the course of events and restrict our work solely to the local treatment of aborting cows.

The work of getting rid of the disease, of exterminating it from the stock concerned, should therefore always be postponed until the disease has been brought to or has arrived at a standstill, and there has thus been prepared a certain resistance against infection which sooner or later occurs if fresh animals are not brought from healthy stocks. The most suitable time for such experiments is immediately before the animals are sent out to pasture. All the animals should then have their blood examined, and the reacting ones should be kept on a separate pasture. The cowhouse should be disinfected as thoroughly as possible and kept as long as feasible free from animals. When the animals are returned to the cowhouse in the autumn there should be established sections for reacting and healthy animals, and those which show sign of approaching abortion should at once be placed in another box and not be removed until they are clean again. Animals in the reacting section should be treated with subcutaneous injections of killed abortion bacilli, and the healthy section should have a blood examination twice a year. A very important point is to endeavor to trace the chronic bacilli excretors (with the milk), which has hitherto only been possible with small herds where there are few reacting animals. Such chronic bearers should be removed from the stock as quickly as possible, since they are undoubtedly the principal reason why the disease remains in a stock where the infection has acquired a more chronic character.

Another method in the campaign against abortion in more severely infected stocks is to undertake systematic vaccinations of the non-pregnant animals with living abortion bacilli. The numerous experiments which have been made and the large amount of statistical material from a number of countries undoubtedly show that in this manner we can reduce the cases of abortion quite considerably, but these reports give no clear account as to the inconveniences which this vaccination causes. It is, however, certain that vaccination with living bacilli will always help to keep infectious matter living in the stock concerned, and that it will be difficult thereby to put a final end to the disease.

Contagious Abortion in Cattle, Sheep and Pigs[10]

1. Abortion caused by *Bacterium abortus* Bang is widely-spread and responsible for serious losses in civilized countries which have highly-developed breeds of cattle. There are in addition cases of contagious abortion, which are of less economic importance than Bang's disease, caused by other organisms.

2. In order to control contagious abortion effectively, it is essential to determine with care the cause in every outbreak, whether the disease occurs extensively or sporadically.

3. In practice, proof of the existence of infection with Bang's bacillus can be furnished by the careful application of the various methods of diagnosis, and particularly by the repetition of tests at definite intervals.

4. Naturally, infection takes place by the alimentary tract. Infection during copulation plays a much smaller part, but it should not be lost sight of in controlling the disease.

5. The most frequent cause of an outbreak of the disease is the introduction of newly-purchased animals which are in a condition of latent infection, and also of animals which give negative serum tests.

6. Scour in calves is frequently due to a primary infection with *Bacterium abortus* Bang, with which secondary invaders are associated.

7. Bang's disease cannot be controlled by attention to hygienic measures alone. But hygiene is a very important factor.

8. The use of living and dead vaccines against contagious abortion has been found valuable when systematically applied, but they have by no means furnished a complete solution to the problem of immunization. The production of a suitable process of protective inoculation is a matter for urgent investigation.

9. The chemotherapy of contagious abortion merits further elaboration.

10. It would appear that the conrol and prevention of the disease is more suitably a matter for private action than for veterinary police measures. It is desirable that the breed societies should undertake protective measures for the prevention of the spread of the disease.

11. Infectious abortion of the sheep and pig is of far less economic importance than the bovine disease. The present state of our knowledge indicates that contagious abortion in these species is not very widespread, and control is practicable on sound etiological lines.

12. The *Bacterium abortus* Bang is of pathogenic importance for the human species. Such infections do not appear to occur very frequently in man. The disease occurs in veterinary surgeons because their professional occupation brings them into touch with parturition cases. In other cases the disease appears to be caused, as a rule, by the drinking of raw cow's milk. Heating the milk to 63°-65° C. (143.4°-149° F.) suffices to kill the organism. Further investigations are required with regard to Bang's disease in man, its connection with the specific infection of cattle, the various methods of infection, and the connection between this disease and Malta fever.

The following resolution is proposed, and, in the event of its acceptance, its submission to the respective governments for appropriate action is proposed.

Resolution

The 11th International Veterinary Congress considers that scientific investigations regarding contagious bovine abortion, which is responsible for serious losses to agriculture and domestic economy, are essential in all civilized countries, and particularly for the purpose of controlling the disease, for the preparation of an effective method of immunization, for the elucidation of the question of the *Bacterium abortus* (Bang) as a cause of disease in man, and the relationship between the disease caused by this organism in man and Malta fever. In view of the very widespread occurrence of infectious abortion of cattle in all civilized countries, an international scientific investi-

[10] Ansteckendes Verwerfen bei Rind, Schaf und Schwein; by Professor Dr. W. Zwick, Director des Veterinärhygienischen und Tierseuchen-Instituts der Universität Giessen, Germany. Presented at the Eleventh International Veterinary Congress, London, 1930.

gation should be carried out, and it is indicated that this investigation comes within the purview of the International Bureau for Animal Diseases in Paris.

Infectious Abortion (Bang) in Swine[11]

1. The sepsis of abortion observed in large breeds of pigs, such as English breeds, in two districts in Northern Caucasus in 1929 was caused by bacilli.

Bang's bacillus was obtained in culture from the stomach contents of aborted fetuses in one case, and in three directly from the uterine horns. In five other cases, in which bacteriological examination of the genital organs of the sows was undertaken, Bang's bacillus could not be detected. The bacillus isolated was pathogenic for guinea-pigs.

2. The blood-serum of all aborting and barren sows, as well as of some of the boars, agglutinated both porcine and bovine strains of the bacillus equally in dilutions up to 1 in 1,500.

3. It may be concluded that sterility in a considerable number of sows, and that the paralysis of the hind legs of a few sows and boars which were observed in these districts, are in at least some of the cases which we investigated to be attributed to infection with Bang's bacillus.

4. In the majority of cases, sows which had become infected with contagious abortion developed serious illness within two or three weeks and then recovered rapidly. The capacity of their sera to agglutinate Bang's bacillus completely cleared up the suspected nature of those cases.

5. The following conditions were found in the genital organs of pigs slaughtered on account of infection with abortion or sterility by post-mortem and histological examination:

Catarrh of the mucous membrane of the vagina, uterus, and fallopian tubes. In two instances a purulent catarrhal exudate was found. The vaginal folds and the uterine glands showed centers composed of necrotic detritus. The individual uterine glands were distended to form cysts with serous contents.

[11] Abortus Infectiosus nach Bang bei Schweinen; by Prof. A. Uranov and Prof. B. Bohl; Aus dem Staatsinstitut für Experimentelle Veterinär-Medizin in Moskau, U.S.S.R. Presented at the Eleventh International Veterinary Congress, London, 1930.

B. Abortus in the Milk of Cows[12]

1. In cows that have aborted, there frequently occurs milk-infection caused by *B. abortus*.

2. This infection appears, as a rule, as early as during the first week after the abortion.

3. The milk-infection caused by *B. abortus,* which appears during the first month after the abortion, ought, probably, to be considered as an autogenous infection from the infected uterus.

4. This autogenous milk-infection is sometimes of *long,* sometimes of *short duration,* that of short duration appearing to be somewhat more common than that of long duration.

5. *The milk-infections of short durations with B. abortus usually disappear* during the period 2-6 weeks after the abortion; in most instances within 3-4 weeks afterwards.

6. *Milk-infections without causal-connection with the abortion, but caused by* B. abortus, *frequently appear 6 weeks to 5 months after an abortion.* These milk-infections should be considered as infections caused by the surroundings. They are sometimes of long, sometimes of short, duration, the number of cases in each instance being about the same.

In consequence of these new infections, the number of milk-infections can remain fairly constant, from the day of abortion until 5 months later on.

7. Only few cows, which have aborted, escape milk-infection by *B. abortus.*

8. As a rule, the bacillus-amount, in this milk-infection with *B. abortus,* is small; it is relatively seldom that the bacillus-amount is high.

The following points should be empha-

[12] On the Percentage of B. Abortus in the Milk of Cows That Have Aborted in Consequence of Infection with B. Abortus Bang; by Prof. Sven Wall, D.V.M.; Director of the State Veterinary Bacteriological Institute, Stockholm, Sweden. Presented at the Eleventh International Veterinary Congress, London, 1930.

sized from the point of view of milk-hygiene:

1. As cows that have aborted frequently eliminate *B. abortus* with their milk, we are probably right in surmising that this is done, too, by infected cows which calve normally (the number of such cows is as great as that of the animals which abort).

2. As new infections are common, attended with elimination of bacilli in the milk six weeks to five months after an abortion, we are probably correct in supposing that these new infections are not restricted entirely to cows which have aborted, but that they are spread generally throughout the herd.

3. If respect be thus paid to the circumstances stated above in points 1 and 2, we ought to be right in supposing that in a herd which is infected with the disease of infectious-abortion the individual cows often eliminate *B. abortus* with the milk, irrespective of whether the cows in question have aborted or not.

4. In such herds, any regulations or directions that may be given respecting the treatment of the milk for the purpose of removing infectious elements, should not be restricted to individual animals, but should apply to the whole herd.

Sterility in Cattle[13]

Since Albrechtsen and Hess reported on sterility in cattle to the 9th International Veterinary Congress at the Hague (1909) it has been established that Albrechtsen's views were correct:

1. That uterine catarrh is the most frequent cause of sterility.

2. That abnormalities of the ovary (cysts and persistent corpora lutea) are not of so frequent occurrence, and that when they are actually present they are generally the result of uterine catarrh.

3. That follicular vaginitis generally plays a subsidiary part in sterility.

It has since been shown:

1. That inflammation of the fallopian tubes occurs more frequently than has been supposed.

2. That spermatotoxic substances play a part in the production of sterility.

But as yet there is no general agreement regarding this. There are still practitioners who attribute sterility very largely to the existence of ovarian cysts and persistent corpora lutea, in the first place because they can detect no clear clinical evidence of uterine catarrh, and in the second place because they think that by rectal examination they can with certainty detect cysts or persistent corpora lutea.

This is, however, certainly not correct. Cysts can be detected during life only when they are very large, and further, it is impossible to determine the persistence of corpora lutea, even when they can be felt, at a single examination.

It would be better to diagnose disease of the ovaries only when animals do not come into season regularly. That it is not always possible to make a clinical diagnosis of catarrh of the uterus is explained by the fact that in many instances it can be detected by post-mortem examination or by the microscopic examination of sections only. These changes, even though they are slight, may quite as well produce sterility through spermatotoxic substances as catarrh, which can be recognized readily by clinical examination.

The most important type of sterility is the enzootic, and usually temporary, type. This form occurs also in heifers, and sometimes in heifers only. Many observers agree with Albrechtsen that uterine catarrh does not often occur in heifers and that it is generally due to parturition or to retention of the afterbirth. This view is not correct. Even in sterile heifers uterine catarrh plays, at least in a later stage, a more important part than diseases of the ovary. But in young animals catarrh can often be detected by microscopic examination only.

Does the same catarrh, which can be detected later in heifers, exist at the first covering? Certainly not in the same form and to the same extent.

Perhaps this temporary sterility of young

[13] Die Sterilität des Rindes; by Prof. Dr. J. Wester; Klinik für innere Krankheiten, Fakultät der Tierheilkunde der Universität in Utrecht, Netherlands. Presented at the Eleventh International Veterinary Congress, London, 1930.

animals is primarily caused by an as yet unknown virus, which is acquired by way of the alimentary canal. This is an important problem, and it is possible that its solution will throw new light upon the causes of sterility.

Therapy must be more rational than formerly. In the first place the virus of the early stages of sterility must be the subject of more comprehensive attack than hitherto, and as far as possible by vaccination with polyvalent vaccines.

More must also be done in the future with vaccination for *prophylactic* purposes.

Other causes of sterility, whether primary or secondary (cysts) to uterine catarrh, or depending upon defective management or feeding, are of infrequent occurrence in Holland.

Prophylaxis and Therapy of Sterility in Cows[14]

Physiology, etiology and pathogenesis form the foundation of methods of prevention and cure of sterility in bovines. The causes of sterility are more varied than was formerly thought to be the case. As external alimentary causes the following must be taken into consideration: Hunger, and possibly also overfeeding, particularly with diets which are not correctly balanced, deficiencies of vitamins and iodin. Prophylaxis depends upon the provision of a diet which is correctly balanced in quality and quantity. Another external cause is insufficiency of light, which causes disturbance of metabolism and organic function. It also decreases resistance to infection.

The internal, extragenital causes of sterility are to be sought in the first place in the endocrine glands, especially in those which are in synergetic (or antagonistic) connection with the genital apparatus, the pituitary, thyroid, adrenals, epiphysis, and thymus. These endocrine glands are dependent upon external conditions, for example deficiency of vitamins causes their atrophy.

Excessive milk production can be considered only as a special cause of sterility when there is a disproportion between the diet and the amount of milk produced by the animal. There are no grounds at present for supposing that internal secretory relationships of the mammary gland are in any way connected causally with sterility. The nervous system connects the genital apparatus with the body, and this with the outer world. The function of the generative organs is dependent upon normal sympathetic-parasympathetic equilibrium, and this again on the conditions of life, for example, nutrition, light, and the functioning of the endocrine glands, as well as ion-equilibrium of the body fluids. Prophylaxis depends upon general attention to hygiene.

Therapy must be based upon physiological and etiological grounds. Recently there have been associated with the older methods of local treatment—removal of cysts and persistent corpora lutea—the hormone treatment. These comprise the injection of organ-preparations, or implantation of endocrine glands (ovary, corpora lutea, pituitary). The control of the sympathetic-parasympathetic equilibrium is a problem for the future. Above all it must be our endeavor in therapy and prophylaxis to keep in mind not only the genital apparatus, but the whole animal body.

Sterility—Its Prophylaxis and Treatment[15]

The rearing of individuals with high fertility begins with the parents of the animals to be selected. The author has illustrated and discussed many of the factors which may lead to infertility. Among the points considered are: (*a*) The value of breeding records, (*b*) duration of gestation, (*c*) the state of the fetal fluids and the placenta at the time of birth, (*d*) condition of the female genitalia after parturition, (*e*) calfhood diseases, and (*f*) hereditary influences. All of the above factors should be considered in the prevention of sterility.

[14] Prophylaxis und Therapie der Sterilität des weiblichen Rindes; by Prof. Dr. W. Frei; Veterinär-Pathologisches Institut der Universität Zürich, Switzerland. Presented at the Eleventh International Veterinary Congress, London, 1930.

[15] Sterility—Its Prophylaxis and Treatment; by R. L. Conklin, D.V.M., M.Sc.; Assistant Professor of Animal Pathology, Macdonald College, Quebec, Canada. Presented at the Eleventh International Veterinary Congress, London, 1930.

Females born after the dams have long been sterile, those born after an abbreviated period of gestation, and those born from infected uteri are usually weak and sick at birth or die soon after birth, but those that do survive arrive at breeding age hopelessly sterile in some cases, or continue the chain of genital disease in the herds.

Prolonged gestation in the bovines has been observed among the progeny of two sires. With the sires mentioned, over 25 per cent of the offspring were born after periods ranging from 289 to 299 days of gestation.

Examinations of the fetal fluids and of the placentæ were found to be of inestimable value in making an early diagnosis of disease conditions which might lead to sterility. The method applied in inhibiting the ravages of infection is to follow the diagnosis by proper treatment.

Vascular disturbances in the various portions of the organs (genital) offer an additional means of detecting changes of the organs which might be accompanied by reduced fertility.

A remnant of the Muellerian ducts frequently persists in the vagina and serves as a barrier to fertilization. Surgical intervention has been found satisfactory if applied at an early date.

Diseases of calfhood, forced lactation and faulty nutrition are among the conditions which may be of tremendous importance in the production of sterility. They may be prevented from bringing about the fatal effects through correcting the management of the herd.

A tendency for sterility to appear in families and to lead to the elimination of families has been noted. This phase of the problem will require further study.

The influence of the sire upon the fertility of the females to which he is bred and upon his progeny was observed. The author believes that the selection of a sire should receive more attention than has previously been given if sterility from this source is to be prevented. Data from some herds would indicate that the offspring of diseased sires suffer more severely from vaginitis and are frequently sterile as a result of the vaginal condition.

The chief hope for relief from the enormous losses from which the livestock industry has suffered, and is suffering, remains with the preventive measures outlined. The selection of individuals should be based upon all known information concerning sexual health, observations, clinical examinations and laboratory tests. No one thing should be overlooked in the complicated chain of causal agents, if we are to arrive at the place where we can prevent sterility among animals.

Treatments are to be based upon factors which produce the condition in individual animals. A combination of all known methods should be applied. Clinical work of manipulation, irrigation of the organs, the injection of glandular extracts and tissue transplants may be used upon suitable cases. A correct diagnosis is the first essential in all cases.

In the author's opinion, treatment should be applied only when the animal may be restored to usefulness and when the factor which induced the sterility may not be handed on to the progeny.

The Prevention of Breeding Diseases[16]

In Germany the diseases connected with breeding—sterility, abortion and the diseases of young animals—play a part of great economic importance. For their control, an organization has been created with headquarters at the Institute of Hygiene of the Veterinary High School, Hanover, whose work is shared practically equally between the State Veterinary Institutes and the Bacteriological Institutes of the Chambers of Agriculture.

The co-operation of all veterinary surgeons and farmers is obtained by propaganda through the medium of lectures, publications and leaflets.

The appropriate institutes carry out the bacteriological and serological investigations in each case, give advice as to suitable steps

[16] Die Bekämpfung der Aufzuchtkrankheiten; by Prof. Dr. H. Miessner; Direktor des Hygienischen Instituts der Tierärzlichen Hochschule, Hanover, Germany. Presented at the Eleventh International Veterinary Congress, London, 1930.

to be taken, and carry out thorough scientific investigations. The material dealt with by the some thirty places at which investigations are carried out is collected, sifted, and forwarded to the central office for further working up, and every two years a general report is issued.

Discussions at veterinary meetings held at various centers in the breeding districts are published in this report. Since 1923 five meetings have been held respectively at Hanover, Göttingen, Jena, Munich, and Stuttgart, for the discussion of special subjects and local breeding problems. The organization has already contributed materially to the control of these diseases.

Horses. Paratyphoid abortion of equines, formerly increasingly prevalent, has been completely suppressed. The diseases of foals are being investigated continuously, and a fairly accurate survey of the occurrence of the various diseases is possible from the statistics collected. Pyosepticemia and infections due to diplo- and streptococci which occur during the first few days or weeks of life are the more important, while paratyphoid infections and diarrhea due to the coli-aerogenes group are of less importance.

Cattle. The losses from sterility are being reduced to a considerable extent. In infectious abortion, however, there is no generally accepted view as to the manner of its spread or the proper methods of control. Slow progress is mainly due to the absence of combined attack on the disease. The relative advantage of living or dead vaccine is not settled. The Central State Commission on abortion has issued instructions regarding hygienic measures and inoculation with, for the most part, living cultures. From the results obtained on farms dealt with on this plan, definite conclusions may be drawn with regard to persisting defects. Experiments on a large scale should be carried out by various institutes employing different vaccines and different methods of vaccination.

The fundamental work of Jensen and Poels has not furnished any fresh results regarding the origin and control of the diseases of calves.

Pigs. Sterility and abortion in pigs are of lesser importance. But every year great losses are caused by diseases occurring during the first few weeks of life and after weaning, due to diplostreptococci, coli-aerogenes, *B. suipestifer* and *B. pyogenes.* An equal loss is probably due to hog cholera. It appears to be questionable whether the causes mentioned are primary, but defective management, unsuitable food, damp and cold sties and climatic conditions play an important part. Nusshag has shown that the majority of deaths occur with changes of weather in the spring and autumn.

Sheep. Abortion in sheep caused by *Bact. paratyphi abortus ovis* is widespread. The most frequent diseases in lambs are due to bipolar organisms, diplo-streptococci, *B. coli* and *B. pyogenes* combined with defective management.

It is proposed that an international committee be formed with a central or co-ordinating office at the head for the investigation and control of the diseases connected with breeding, sterility, infections, abortion, and the diseases of the new-born.

Vaccination Against Rabies[17]

There can be no doubt that the efficacy of the campaign against rabies is dependent upon the rigid application of well recognized sanity police measures.

The more severe, exact, energetic and vigorous the regulations, the more certain the results.

But it is not possible to apply rigorously all the measures suggested by science and by experience, even in countries where those in charge of the prevention of contagious diseases of animals are the staunchest supporters of the necessity for severe regulations, and in countries where legislative enactments are respected.

It is, in fact, one thing to apply such regulations in connection with pleuro-pneumonia, cattle plague and glanders, where the only factor concerned is an economic one,

[17] Rage (Vaccination); by M. le Prof. Guido Finzi; Directeur du Laboratoire de Pathologie Spéciale et de la Clinique Médicale de l'Ecole Vétérinaire Supérieure de Milan, Italy. Presented at the Eleventh International Veterinary Congress, London, 1930.

but it is quite another matter to apply them in connection with rabies in dogs because of the introduction of a psychological factor, which is, in some cases, a very prominent one.

The campaign against rabies should be supplemented, as is the case already in several countries, by the compulsory protective and curative vaccination of dogs.

The glycero-carbolised vaccines, which are based upon a discovery by the Italian school, serve this purpose. The prophylactic vaccine is remarkably effective, and it has been confirmed by a number of investigators that a single injection confers immunity against any kind of natural infection whatsoever. It has also been shown that doses far larger than those used for vaccination are absolutely harmless.

The statistics of the Japanese Ministry of Agriculture, the use of vaccines in America, Portugal and Italy are very impressive.

Curative vaccination is always recommended when the owner of the animal bitten cannot be compelled to have the animal destroyed. If the curative vaccination is carried out immediately after the animal is bitten, and even if the bite be a severe one. the dog is certainly protected. If, on the other hand, there is some delay in vaccinating, a good response is obtained, because it shortens the period of incubation and prevents the development of the disease after the termination of the usual period of observation.

The preparation of considerable quantities of vaccine is by no means a difficult matter because fixed virus of canine origin can be used in place of fixed virus from rabbits, with the advantage that it prevents the very occasional untoward developments, reported by certain investigators, which are certainly due to the heterogeneous nature of the nerve substance.

The limited amount of nerve substance necessary, and the duration of the activity of these vaccines, make it possible to repeat the protective inoculation of dogs annually.

When one takes into consideration the fact that there is no need whatever to carry out the vaccination at a particular age (Hutyra) (since it can be practised upon dogs of any age) one realizes that the systematic vaccination of dogs is less complicated and easier of realization than one has been led to believe.

For reasons that will readily be understood, it has never been thought advisable to vaccinate cats against rabies.

The curative vaccination of the large herbivora (solipeds and ruminants) against rabies which has yielded such encouraging and certain results (Aujeszky) should be considered as an economic question, and not intimately connected with the special problem of rabies prevention.

Basing our opinion upon the results we have obtained and taking into consideration those obtained by other investigators, we wish to conclude, with our eminent master, H. Vallée by stating that: "Vaccination by carbolized, etherized and formolized virus has furnished such proofs of its harmlessness, and also of its efficacy, that it would be advisable, if not to make it compulsory, at least to favor the widest possible application of it," and by resolving that the sanitary authorities of the various countries should, in order that the campaign against rabies may be more effective, make antirabic vaccination compulsory as well as enforce sanitary police regulations.

Protective Inoculation of Domesticated Animals Against Rabies[18]

Protective inoculation of domesticated animals against rabies may assist in our campaign on the one hand as an inoculation carried out after infection in order to save animals that have been infected, and on the other hand as a protective inoculation, particularly for dogs, for the purpose of preventing the spread of the disease.

In the great majority of cases domesticated animals which have been infected are saved by post-infectional inoculation.

From the practical standpoint any method of protective inoculation which is used after

[18] Wutschutzimpfung der Haustiere; by Professor Dr. Aladar Aujeszky; Professor an der Kgl. Ung. Tierärzlichen Hochschule, Budapest, Hungary. Presented at the Eleventh International Veterinary Congress, London, 1930.

infection has occurred must be capable of establishing immunity within a short time, by simple means, with few injections at small cost, and it must be free from the danger of producing the disease itself or other undesirable consequences.

At the present time the methods which may be held to satisfy these conditions most closely are those in which fixed virus which has been attenuated by carbolic acid or by ether, and which require at most six or seven injections, and the simplified "dilution method" which has been in use with satisfactory results in Hungary for the last thirty years.

Animals which are in an advanced stage of pregnancy withstand these methods well. Milk from inoculated animals, provided they are otherwise healthy, can be placed on the market without hindrance, because experience shows that fixed virus injected subcutaneously is not detectable in the milk. The inoculation produces little or no reduction in the quantity of milk secreted.

Post-infectional inoculation must always be carried out early, but it may be borne in mind that in approximately fifty per cent of cases, and particularly in horses and cattle, the period of incubation may be more than a month and not infrequently is even more than three months. There are, therefore, no grounds for considering that it is too late to carry out inoculation if some weeks have elapsed since infection occurred. There are no means of knowing beforehand how long the period of incubation will be.

Protective inoculation of dogs does not render stringent regulations superfluous, but affords them valuable support. In countries where rabies rarely occurs it can be controlled by the application of regulations alone, but where the disease is widespread annual protective inoculation is to be recommended in addition to the enforcement of official regulations.

By the Japanese method it is possible, with a suitable fixed virus, to produce a good degree of immunity with a single injection. If every care is taken regarding asepsis and a strict technic is followed complications such as abscess formation and dermatitis do not occur. Miessner's vaccine, which is prepared from rapidly dried fixed virus, also produces a good immunity by means of a single injection only. Other methods which involve several injections can never be used for the protective inoculation of dogs in practice.

In connection with the stamping out or rabies it is proper to destroy those dogs which, subsequent to and in spite of protective inoculation, develop rabies. If, however, they are only under suspicion of being rabid, they should be kept under observation for several months.

Post-infectional inoculation of dogs is best avoided, and should be limited to valuable animals in places where the law does not insist upon the destruction of dogs suffering from rabies. Cats should not be immunized against rabies. Protective inoculation of other domesticated animals can be considered only for animals of especial value in heavily infected areas, because prompt inoculation after infection is as a rule successful.

Distemper (Etiology and Vaccination)[10]

Owing to the variety of symptoms and lesions it has been possible to compare Distemper with a good number of more or less similar conditions affecting man and other animals (typhus, glanders, influenza, measles, strangles, etc.).

The bacteriological examination of the obvious lesions allowed organisms which could be stained and were easily cultivated (pasteurella, *B. bronchisepticus*) to be put forward as specific agents. These, however, were quite incapable of setting up a condition which was really contagious.

In 1904, Carré showed that discharge in the early stage of the disease, filtered or not, produced a rapidly fatal septicemia with a severe thermal reaction, which was typical and pathognomonic. This discovery was received with almost complete skepticism, which persisted for more than twenty years, although it was confirmed by Lignières in 1906 and by Eyguene in 1912.

[10] La Maladie des Chiens: Etiologie et Vaccination; by Prof. Dr. H. Carré; Directeur-Adjoint du Laboratoire National de Récherches, Alfort (Seine), France. Presented at the Eleventh International Veterinary Congress, London, 1930.

A work by Kregenow (1909) called in question the existence of a filterable virus; but the technic of this author is so rudimentary that one is amazed at the importance accorded to this work, without criticism and without verification. The investigations of Lebailly and then those of Durkin and Laidlaw finally confirmed Carré's conclusions and definitely eliminated any organism which could be stained and cultivated as a cause of distemper in dogs.

By treating with formalin the virulent brain substance (Puntoni) or the spleen (Lebailly, Dunkin and Laidlaw) it is possible to obtain a vaccine which will induce a certain degree of immunity. However, it seems that this must be reinforced by an injection of living virus.

The efficacy of this process of vaccination by two interventions is dependent upon the maintenance of the activity of the virus during transport to the place where it is used.

Should the existence of several varieties of virus be established this would be a serious check to the use of the vaccination on account of the difficulties of maintaining them.

Etiology of and Inoculation Against Distemper[20]

All writers are in agreement on the clinical symptoms of distemper save with regard to the pustular lesion. This comparative unity of view is in marked contrast with the divergence of opinion regarding the cause of the condition, and regarding its non-infectious or its infectious nature. The clinical characters of the disease are very variable and are not specifically characteristic. It is frequently impossible to diagnose differentially between spontaneous diseases, so-called canine typhus, angina tonsillaris caninum Carlin, parasitic infestations, deficiency diseases, and avitaminoses. Broadly speaking, these results rather contraindicate bacteria or virus alone as being the cause of distemper.

It is interesting to note the percentage increase in the number of cases of distemper at the Berlin Clinic resulting from the war and the inflation period, which, with improvement in nutrition, dropped again. The angina Carlin resembles frequently the harmless experimental type of distemper of Laidlaw and Dunkin.

The author confirms the occurrence of a slight transitory catarrh, which may be followed by nervous symptoms. The clinician does not at the moment accept any particular cause as responsible for the well-recognized symptoms of distemper. The contradictory statements in the literature: Infectiousness —non-infectiousness, immunity after recovery—non-immuntiy, the same treatment sometimes giving positive results and sometimes negative, suggest different causes of the symptoms presented. The observations refer to different diseases. An attempt must be made to bring these opposing views into agreement. The investigation of distemper has resolved not a disease which in itself is harmless, but a malignant one. The name distemper is due to the secondary infections, the occurrence of which may be favored in many ways, and it is these which require investigation.

Inoculation depends upon non-acceptance of the view that the cause of the condition is bacterial only or in the nature of a virus. It has not been possible to produce by transmission a single train of symptoms, nor has one of the already innumerable vaccines

The Head of a Champion Blood Hound.

[20] Ueber Aetiologie und Impfung der Staupe; by Prof. Dr. W. Hinz; Direktor der Klinik für Kleine Haustiere der Tierärzlichen Hochshule, Berlin, Germany. Presented at the Eleventh International Veterinary Congress, London, 1930.

proved its value in practice. Nor can a specific vaccine, in our present state of knowledge, be effective, because it must be used not only for distemper but for all the diseases resembling distemper clinically. On account of its specificity it cannot be effective against these, and it must therefore fail. Not only is it impossible to assess its value, but it must lead to erroneous conclusions. The same is true for protective inoculation.

Up to the present the causation of distemper has been practically investigated in part only, namely, bacteriologically, and no solution has been forthcoming. Clinicians, parasitologists, nutritional physiologists, and pathologists must work together. In view of the differences of opinion held the formation of an international distemper research committee to investigate the problem systematically and rationally is recommended.

Dog Distemper. Etiology and Vaccination[21]

The work of Carré (1905), which resulted in his contention that the causal organism of dog distemper was a filterable virus, although to some extent contradicted by Ferry (1911, 1912), Torrey and Rahe (1913), McGowan (1911) and others, is now generally accepted by most workers.

The most recent work has been carried out by Puntoni (1923, 1924), Labailly (1927) and Laidlaw and Dunkin (1926, 1928). All these workers support the Carré theory and all claim to have manufactured vaccines from various tissues of the body, the use of which, it is claimed, prevents the disease in susceptible animals.

Puntoni's brain vaccine was prepared from the brains of dogs which were suffering from distemper encephalitis and he passed the virus from dog to dog by means of intracerebral inoculation. Lebailly made use of the spleen from infected dogs. Laidlaw and Dunkin have used spleen, liver and mesenteric glands and, in suitable animals, brain also. Their method was to make a 20% suspension of mixed organs with normal saline and a final addition of formalin to bring the percentage of formaldehyd up to 0.1%. Five cc of this vaccine is the dose recommended for each dog treated, and this is followed one week later by a small dose of living distemper virus. A 1% suspension of spleen obtained from a ferret in the later stages of the disease is the medium in which the virus is given.

Dogs and hounds which have now been vaccinated over three years still appear to be quite immune and have suffered no ill-effects after being placed in contact with clinical cases of the disease. It would appear also that not only are these vaccinated animals immune to distemper, but they have also a high degree of resistance to the usual secondary invaders met with in field cases of the disease.

An important step in the manufacture of the products is that an attempt must be made to ascertain the approximate virus content of the suspension before the formalin is added, and this is done by the injection of falling doses into susceptible ferrets. The protective power of the prepared vaccine is also tested on dogs known to be susceptible before issue is permitted.

Breakdowns have occasionally occurred, and in those cases in which the immunity appears to have waned the explanation has been as follows

(1) The patient was peculiarly susceptible, and

(2) The virus, at the time of injection, was impotent.

It is believed that if this method is to be successful, not only must the vaccine be of high quality, but the virus which is administered after the vaccine must be potent.

There is much evidence today in support of the view that although the immunity resulting from an attack of distemper may be partly cellular, it is also due in part to circulating antibodies.

There is no doubt that it is possible to obtain a serum which would be of some value in the treatment or even the prevention of the disease, but it would seem desirable to evolve some means whereby one

[21] Dog Distemper—Etiology and Vaccination; by Major Geo. Wm. Dunkin, M.R.C.V.S., D.V.H.; Veterinary Superintendent of the Farm Laboratories of the National Institute for Medical Research, Rhodes Farm, London, N. W. 7, England. Presented at the Eleventh International Veterinary Congress, London, 1930.

could define the conditions necessary for the production of serum of reliable potency, and work now in hand leads us to suppose that this may be possible.

Spontaneous Cow Pox[22]

So-called natural cow-pox occurs rather often in Holland. It has been impossible to demonstrate any relation between this disease and vaccinated persons.

Most probably cow-pox is not an original cattle-disease.

To explain the occurrence of this disease in cows, we have to think not only of vaccinated people, but also of fowl-pox and horse-pox. (Insects and other intermedial carriers.)

It is worth while to seek for natural cow-pox to get a new vaccine strain.

Infections from cattle to men happen very often; the measures against them may consist in the vaccination of the cows during the non-lactating period.

It is desirable to make a careful study of the epidemiology of cow-pox.

The Variolas of the Domesticated Animals[23]

The diseases classified as the variolas are contagious, inoculable, eruptive diseases which are either common to several species of animals or specific for one, and present practically identical clinical characters.

Vaccinia occurs naturally in the horse (horse-pox), cow (cow-pox), camel, goat and pig. It is inoculable to all the domesticated animals.

Variola of the goat is specific to that species, it attacks from 25 to 100 per cent. of herds, and runs a benign course. Variola of young pigs is specific for the pig, and rarely affects animals more than 2½ months old. The younger the animal affected the more serious the condition.

Sheep-pox (variola ovina) is a serious disease which is specific for the sheep.

Causation of the Variolas.—The cellular inclusions which were at first regarded as protozoa are composed of a mass of fine granules described as microbial elements.

Cultivation (of vaccinia) has been achieved outside the animal body, but almost exclusively with the help of a tissue culture.

The virus is always present in the specific lesions. It is capable of passing through certain filters.

Pathogenesis.—The symptoms vary with the path of inoculation. The variolas, which are diseases of epithelium, may also affect tissues other than those derived from the ectoderm. The faculty possessed by the virus of sheep-pox of growing in tissues of mesodermic origin has been taken advantage of in order to cultivate it *in vivo* in the subcutaneous connective tissue.

Variations in Virulence.—The virulence may be reduced by the passage of the virus to a different species of lower susceptibility, or to an animal of the same species which is less susceptible. In the course of outbreaks the variolas sometimes show sudden exaltations of virulence.

Immunity.—Natural immunity is rare. It may be a character of a particular breed (Breton sheep resistant to sheep-pox). Each of the variolas immunises against itself. Vaccinia immunises against human variola, and the latter against vaccinia.

The immunity acquired is durable, but it is not of indefinite duration.

Active immunity is produced by variolisation, which in the case of sheep-pox is termed clavelisation. In sheep-pox it is produced by the injection of the killed virus, by sero-clavelisation, and vaccination with sensitised virus. The injection of killed virus is of no practical interest.

Clavelisation is effected either with normal virus or with virus alternated by the action of heat, ethyl ether, formol, ethyl aldehyd, passage through sheep possessing a certain degree of immunity, or through the goat.

Sero-clavelisation comprises two operations which are carried out simultaneously;

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[22] On So-called Spontaneous Cow-pox; by Dr. H. S. Frenkel; Chief of the Veterinary Department of the State Laboratory for Public Health, Utrecht, Netherlands. Presented at the Eleventh International Veterinary Congress, London, 1930.

[23] Les Varioles des Animaux Domestiques; by Dr. Vre J. Bridré; Chef de Service à l'Institut Pasteur, Paris, France. Presented at the Eleventh International Veterinary Congress, London, 1930.

clavelisation by intradermal inoculation and the subcutaneous injection of anti-sheep-pox serum.

Vaccination with sensitised virus presents the following advantages: the absence of an infective lesion, and the early production of a lasting immunity. It is employed both in healthy and infected areas. Since 1913, 21 million sheep have been vaccinated in different countries.

The injection of anti-sheep-pox serum confers an immunity which lasts for 15 days. Sero-therapy can be used for curative treatment.

The Relationships Between the Variolas. —It can be admitted that the viruses of the various variolas have a common source, but experimental proof of this community of origin has not been furnished.

Variola in Domesticated Animals[24]

1. An infectious exanthematous disease, common to the sheep and the goat, which is termed Contagious Pustular Dermatitis, has a wide geographical distribution. It has been established that the disease is caused by a filterable virus which, in the absence of secondary bacterial invaders, evokes a characteristic vesico-pustular eruption bringing the condition into close relationship with members of the vaccinia-variola group.

The disease, therefore, seems to merit inclusion under the general term "variola"; nevertheless, it is not easy to assign to the virus an exact position in the pox group on account of the confusion which exists regarding the relationship between ovine, caprine and porcine variola, vaccinia, horse pox and contagious pustular stomatitis of the horse.

2. In the experimental disease, the stages of papule, vesicle, pustule and scab can be clearly recognized in which respect the lesions present a marked resemblance to a vaccinal eruption, but a differentiation can be drawn between the two diseases on the grounds that dermatitis is not transmissible to the rabbit, and also that sheep immune to dermatitis still react to vaccinia and vice versa: on similar grounds, dermatitis can be distinguished from sheep-pox. The relationship of caprine ecthyma and variola of the goat is less clear, and further investigations on this point are desirable.

3. A benign and a malignant form of the disease can be recognized: in the former, the lesions present themselves as pseudo-papillomatous growths which are confined to the external aspect of the lips, whilst in the latter, pustular or verrucose lesions are found on the buccal mucous membrance or other parts of the body. Both forms are caused by a single specific virus.

4. The virus will pass through candles of the types Chamberland L*ib*, Berkefeld V and Mandler (6-9 lb.), but infective filtrates are obtainable only with difficulty. The virus is probably intimately associated with the cellular elements from which it can be liberated either by spontaneous autolysis or by the action of trypsin. Under laboratory conditions, the crusts from the lesions retain their virulence unimpaired for at least two and a half years: it is very probable that the high infectivity of the crusts and their resistance to desiccation explain the dissemination and annual recurrence of the disease in certain flocks. The examination of a number of strains from this and from other countries shows that they conform to a single type.

5. The condition known as malignant

Milk Hygiene calls for clipping of dairy cows with more regularity than it is practiced in this country. The above photograph was taken in Holland.

[24] Variola in Domestic Animals. Contagious Pustular Dermatitis of the Sheep and Goat; by R. E. Glover, B.Sc., M.R.C.V.S., Department of Animal Pathology, University of Cambridge, England. Presented at the Eleventh International Veterinary Congress, London, 1930.

aphtha in which the ewes bear vesico-pustular lesions on their udders is also due to the virus of dermatitis. Experimental evidence suggests that the mastitis which sometimes accompanies these lesions is dependent upon the action of the virus *per se* without a bacterial intervention. The introduction of the virus into the udder of the lactating ewe is capable of provoking a subacute form of mastitis.

Latent Infection in Mastitis[25]

Both the clinical and the bacteriological aspects of mastitis have been the subject of numerous thorough investigations. The pathological physiology of the inflamed udder on the other hand is much in the dark. This fact is all the more regrettable since therapeutics and prophylaxis, which should be based upon it, are still very problematic beyond certain long established measures like frequent milking and segregation.

The author adopts the premise that a latent infection, i.e., infection without clinical symptoms of mastitis is present in the udders of all normal milk cows, and that this latent infection differs from the infection causing acute mastitis only quantatively; and further that the latent or normal infection produces a normal or "miniature mastitis" that differs from clinical mastitis in no way except quantatively.

Where the constancy of the inflammatory reaction points to a stationary condition of the gland the number of bacteria per cc in the milk shows also a remarkable constancy.

The correlation between the bacterial count and the reaction of the gland, together with the fact that in latent infection the number of bacteria is comparatively small (average 1,000 per cc) explain why the infection remains latent. Observations show that it remains latent as long as the number of bacteria is low.

The equilibrium between bacterial activity and the inhibitory action of the gland that results in latent mastitis may be disturbed by various external influences but the natural tendency is always to swing back to a state of equilibrium when the dis-influence is removed. So far as we know at present, stagnation of milk is the commonest cause of an increase in the bacterial flora of the udder.

Careful observations have failed to reveal any signs of "increased virulency" and the author is convinced that such phenomenon plays no important part in the pathological changes of the udder.

Finally, it seems likely that clinically normal udders harboring bacteria may act as virus reservoirs for the spread of mastitis, although so far there is no direct evidence of this.

The epizootology of mastitis is still very much in need of detailed observation.

Bovine Mastitis[26]

1. Bovine mastitis is a disease of great economic importance to the dairy industry. The losses from this cause are mainly due to the great prevalence of the disease, specially of the form which is caused by streptococci, and to the fact that it occurs most commonly among cows at the period of life when milk production is at its maximum. The incidence of streptococcus mastitis tends to be highest in the larger herds, in some of which as many as 60 to 80% of the cows may be suffering from the disease in a latent form. Statistics show that on an average, in large herds, between 15 and 40% of the animals may be expected to show infection with mastitis streptococci.

The facts ascertained regarding milk-borne epidemics of scarlet fever and septic sore throat serve as a warning that bovine mastitis has a public health aspect which cannot be safely ignored.

2. The majority of streptococcus strains which may be isolated from chronic mastitis conform to a common type which for the present may retain the name *Streptococcus mastitidis bovis*, while other strains, responsible for some more acute forms, pos-

[25] Latent Infection in Mastitis; by Prof. Dr. W. Steck; Director of the Veterinary Medicine Clinic of the University of Berne, Berne, Switzerland. Presented at the Eleventh International Veterinary Congress, London, 1930.

[26] Bovine Mastitis; by F. C. Minett, D.Sc., M.R.C.V.S.; Director of the Research Institute in Animal Pathology, Royal Veterinary College, London, England. Presented at the Eleventh International Veterinary Congress, London, 1930.

sess characters sufficient to distinguish them from this type.

Apart from streptococci, mastitis may also be caused by staphyloçocci, *B. pyogenes* and coliform bacteria among others. Mastitis due to staphylococci is frequently accompanied by more acute local and systemic changes and is more often fatal than the streptococcic form.

3. The natural method of infection in mastitis has been discussed. In the case of cows in milk, widespread dissemination of the disease is probably brought about by the practice of milking animals indiscriminately, infection entering the udder through sores or abrasions on the teats.

4. The ordinary streptococcic form of mastitis is insidious in its course, and latent infections are so common that laboratory methods are generally essential for diagnosis. These include cultural examination of the milk, microscopic examination of the cream or of the centrifuged sediment, measurement of the sediment volume and estimation of the reaction of the milk. Of these methods, cultural examination in a suitable medium, *e.g.*, blood agar poured plates, can be regarded as the most reliable. With proper laboratory facilities, cultural diagnosis could be used on a large scale in practice, since experience has shown that a large proportion of infected cows can be detecetd by a single examination of a sample of mixed milk from the four quarters. The sediment and reaction tests, when applied to samples of quarter milk, are useful subsidiary methods. These two tests are of outstanding value, however, only when positive, since milk samples may show no excess of cells or increase of alkalinity on occasions when mastitis streptococci can be cultivated from them.

In the present state of knowledge there is no good evidence to show that the resistance of the cow's udder to infection can be increased by vaccination or that complete cure can be effected by any method of treatment now available. A more promising means of control would be to pick out infected cows by appropriate methods and to put into force hygienic measures in order to prevent the dissemination of infection among healthy animals. The future will show to what extent mastitis can be controlled in this way.

Acute Mastitis[27]

The report gives a general survey of the frequency of mastitis and makes a brief reference to the losses to agriculture caused by it. The predisposing causes, the methods of infection, and general aspects of prevention and cure are dealt with broadly.

As an introduction to the etiology of mastitis, the question is dealt with as to whether bacteria occur in sound udders.

The causes of mastitis may be classified as mechanical, chemical and thermal, but the most important cause is bacterial invasion. Only the last of these is considered in detail.

Cases of mastitis may be distinguished as acute and chronic (streptococcic, tuberculous, actinomycotic and botryomycotic) according to the course taken.

The acute infectious forms of mastitis are grouped according to their causes as staphylomycosis, pyobacillosis, coli-enteritidis, Breslaviense-bacillosis, necrobacillosis, bacillary mastitis of the sheep caused by *B. purifaciens* (*B. hemophilus ovis,* Lucet-Dammann bacillus) and contagious agalaxia of the sheep and goat caused by a filterable virus.

For lack of space no reference is made to diseases of the teats and skin of the udder or the lesions of the udder due to foot-and-mouth disease, black-quarter, strangles or abortion.

As occasional causes of mastitis *Bact. pyocyaneus, Bact. vulgare* (*proteus*), *Bact. septicemiæ hemorrhagicæ* (*Pasteurella*), *Micrococcus* (*Sarcina*) *tetragenus* and a special type of yeast are mentioned.

The causes of staphylomycosis of the udder are *Micrococcus pyogenes aureus, albus* and *citreus* (*Staphylococcus mastitidis* Guillebeau), *Micrococcus candicans* Flügge (*Galactococcus versi-color, flavus* and *albus* Guillebeau) and *Micrococcus mastiditis gangrænosæ ovis* Nocard.

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[27] Akute Euterentzündungen; by Obermedizinalrat Prof. Dr. M. Klimmer, Direktor des Veterinär-Hygienischen Instituts der Universität Leipzig, Leipzig, Germany. Presented at the Eleventh International Veterinary Congress, London, 1930.

Pyobacillosis of the udder is caused by *Bact. pyogenes* and necrobacillosis by *Bact. necrophorum.*

Among the causes of specific bacillary mastitis in the sheep are *Bact. purifaciens* Christiansen, *Bact. hemophilus ovis* Mitchell, the Lucet-Dammann bacillus.

Finally, there is filterable virus of contagious agalaxia of the sheep and goat.

The following organisms of the coli-paratyphoid (Salmonella) group occur as causes of mastitis: *Bact. enteritidis, Bact. breslaviense,* and *Bact. coli,* with, in addition, *Bact. acidi lactici* (*Bact. lactis aerogenes*).

Mention is made of Bahr's classification of types of *Bact. enteritidis.*

It has not been possible, as a rule, to give any account of the clinical manifestations or the anatomical findings of these conditions. Therapy and prophylaxis are dealt with in a general way and the question of inoculation is considered.

Active Immunization Against Blackquarter[28]

Immediately after having discovered that *Cl. chauvoei* is the cause of black quarter, Arloing, Cornevin and Thomas began to investigate a method of vaccination. In 1883 they published a method based upon the utilization of dried virulent organic liquids which they attenuated by heat in order to convert them into vaccine.

This method with modifications became generally adopted.

The study of *Cl. chauvoei* and its pathogenicity has always given grounds for criticism of the principle discovered by Arloing, Cornevin and Thomas, and of the occasional accidents which they observed. At the same time this work formed the starting point of new methods. At the present time a number of vaccines which can be divided into three groups are available.

1. In the first group are the vaccines of Arloing, Cornevin and Thomas, and those which were prepared subsequently for the removal of two imperfections; one as regards the presence of bacterial contaminations present with the specific organism, and the other dealing with the irregular resorption of the vaccinating liquid containing a variable amount of albuminous débris in suspension (the liquids for inoculation being prepared at the moment by grinding up the powder vaccine).

Kitt, Leclainche and Vallée suggested the use of cultures attenuated by heat or by age, but this did not affect improvement because the attenuation affected the toxin only, the spores were left unchanged. Special susceptibility of the animals vaccinated was sufficient to allow the spores to multiply and cause accidents. These vaccines are now of historic interest only.

2. The second group comprises vaccines prepared from strains of *Cl. chauvoei* which have an attenuated virulence as a hereditary character. These strains cannot produce infection. Leclainche and Vallée by combining special media with unfavorable temperature have succeeded, at least with certain strains, in achieving this. Polyvalent vaccines are thus rendered possible. This method, which has been in use since 1911, has always given perfect results.

3. The third group of vaccines comprises those in which the bacteria have either been removed by filtration or have been killed by formalin.

(a) "Natural aggressines." These vaccines are prepared by filtration of liquid obtained by grinding up and subjecting to pressure tissues from natural lesions. This

Localized Anthrax (In right shoulder).

[28] Immunisation Contre le Charbon Symptomatique; by Dr. Paul Rinjard, Chef de Service au Laboratoire National de Recherches, Alfort (Seine), France. Presented at the Eleventh International Veterinary Congress, London, 1930.

method was discovered by Roux and has had a wide and satisfactory application.

(b) "Artificial aggressines" are prepared by filtration of artificial cultures. The soluble toxin alone is used. (Roux and Nitta.) To reduce loss of toxin Leclainche and Vallée substitute centrifugation and the addition of 0.2% to 0.5% of formalin for the destruction of the few organisms not sedimented. World-wide application has shown that immunization with toxin is perfectly safe.

(c) The third group comprises whole cultures of different ages killed by formalin (Leclainche and Vallée). In this way the combined action of soluble and endo-toxins is obtained.

It may be asked whether the use of "natural aggressines" should not be abandoned. There are available vaccines containing attenuated bacteria and vaccines toxin without any living organisms. The latter lend themselves more readily to the preparation of auto-vaccines.

Blackleg Vaccination[29]

1. Blackleg is a specific contagious disease caused by *B. chauvaei.*

The view that *B. chauvaei* is not the sole cause of this condition but that other anaerobes, particularly *V. septique* and *B. welchii,* are responsible for a proportion of cases, has not been generally accepted. Strong evidence to the contrary is to be found in the remarkable success which has followed the use of *B. chauvaei* aggressin for the protection of animals against blackleg. On the other hand, *V. septique* and *B. welchii* are two of the recognized causes of "gasedema" in animals. Infection by these organisms usually occurs as a sequel to wounds of various kinds.

2. Very reliable methods of immunising animals against blackleg are now available. The value of aggressin is generally recognized and this product has been used on a very large scale with most satisfactory results. It has proved itself superior to the vaccines previously employed on account of its absolute safety and high immunising value. *Artificial aggressin is to be preferred to the natural product* as it is at least as potent and is much less troublesome and costly to prepare.

The introduction of formalised *vaccine by Leclainche and Vallée constitutes a further important advance in blackleg immunisation.* This vaccine has been used for the protection of animals in affected districts and has been found to be both safe and efficient. Its immunising value, as has been demonstrated experimentally by several independent investigators, would appear to be higher on the average than that of aggressin. The antigenic properties of this vaccine are derived partly from the dead organisms which it contains and partly from the presence of aggressin.

Anthrax, the Prevention of Its Dissemination Through the Medium of Animal Products[30]

In the domesticated animals anthrax is most frequently of alimentary origin, while in the human subject the majority of cases are due to infection by way of the skin and of the respiratory tract. In animals a large dose of organisms is generally necessary to cause infection, while in man a small number is sufficient.

Domesticated animals are exposed to infection through contamination of foodstuffs as a result of slaughter, section, and careless disposal of the carcasses of infected animals. Regulations have led in Germany and other countries to a marked reduction in the number of cases of the disease, but its complete eradication has not been effected.

The causes of this are referrable clearly to war and post-war practices, and it is certain that cases resulting from careless disposal of anthrax carcasses are of far less importance than the risk of infection attaching to anthrax-infected materials (hides, bones, and foodstuffs) imported from

[29] Blackleg (Vaccination); by T. J. Bosworth, B.Sc., M.R.C.V.S., D.V.S.M.; Assistant Director, Institute of Animal Pathology, University of Cambridge, Cambridge, England. Presented at the Eleventh International Veterinary Congress, London, 1930.

[30] Milzbrand, die Verhütung Seiner Verbreitung durch Tierische Rohérzeugnisse; by Professor Dr. Müssemeier; Ministerialdirigent im Preussischen Ministerium für Landwirtschaft, Domänen und Forsten, Berlin, Germany. Presented at the Eleventh International Veterinary Congress, London, 1930.

abroad. The statistics of anthrax infection in man, cattle, and pigs in Germany show a curve which is paralled with that of the importation of hides and foodstuffs. The connection between the occurrence of the disease and the importation of hides is particularly evident in the Province of Schleswig-Holstein, where the leather factories using large numbers of imported hides are situated.

As the importation of animal products is the principal cause of infection with anthrax in man and animals in civilized countries, regulations must be devised to provide effective protection against this danger.

The most strenuous efforts should be made to control anthrax in exporting countries by the safe disposal of carcasses and parts of carcasses infected with anthrax. In countries where this is not yet practicable, other steps must be taken to prevent the spread of anthrax through the medium of raw materials of animal origin. The simplest way of achieving this is the sterilization of all raw meat meal and bones of foreign origin. The most serious risk of anthrax attaches to the importation of hides, and particularly of dried hides. As there is as yet no known method of thoroughly disinfecting hides and completely destroying the anthrax spores contained in them, without causing damage, other regulations are necessary to ensure that no infected hides are allowed to enter general trade. This can be done in the following manner: Ascoli's test has proved itself satisfactory for the examination of dried hides. It should not be an expensive matter for exporting countries to ensure that the hides have not been obtained from animals infected with anthrax by applying Ascoli's test. If there are obstacles to carrying out the test in exporting countries, they must be done by the importer.

The following conclusions are recommended to the Congress for acceptance:

1. The community of interests of civilized peoples makes it an essential duty to take effective precautions for the protection of the health and life of human beings and animals against the dangers of infection with anthrax through animal products—unheated or insufficiently heated meat meal or bone meal, unheated or insufficiently heated bones and skins.

2. In connection with this danger, it appears that regulations are urgently needed to ensure that raw materials only from animals free from anthrax or sterilized are introduced into trade. If the veterinary police regulations of the exporting countries are insufficient for this, it appears to be essential that the products should be sterilized or tested as to their bacterial content in the importing country before they are allowed to pass into general trade.

3. Only an exposure to steam under pressure for several hours can at the present time be considered satisfactory for the thorough disinfection of animal products infected with anthrax.

Control of Dissemination of Anthrax by Animal Products[31]

1. The undoubted fact that through the medium of international trade in animal products anthrax is introduced into other countries imposes upon importing countries the obligation of devising regulations for the prevention of the importation of animal products contaminated with anthrax.

2. Importing countries can therefore demand official certificates that the skins have been obtained from animals slaughtered in slaughter-houses under veterinary supervision, and that the animals shall have been found free from infectious diseases, and especially from anthrax, by veterinary examination both before and after slaughter, and further, that the hides have not come into contact with animals infected with or suspected of anthrax or with objects capable of acting as carriers of anthrax infection.

3. Consignments of hides not accompanied by certificates mentioned under 2 are to be excluded or their importation is to be made dependent upon the result of a thorough examination for anthrax. The same

[31] Vorbeuge bei der Verbreitung des Milzbrandes durch Tierische Roherzeugnisse; by Dr. F. Fischoeder, Direktor des Veterinär-Departments im Polmischen Landwirtschaftsministerium in Warschau, Poland. Presented at the Eleventh International Veterinary Congress, London, 1930.

procedure is to be adopted in the case of consignments of hides from countries in which the Veterinary Police services are not considered satisfactory even though such certificates be produced.

4. Ascoli's technic may be employed with advantage for the examination of hides for anthrax in so far that skins which give a negative result to the test may be admitted without hesitation.

5. A positive reaction to the Ascoli test cannot be held to furnish proof of the presence of anthrax, because in a considerable percentage of cases, in which anthrax can be excluded with certainty, the Ascoli test gives a positive result. In such cases inoculation and cultivation must be resorted to for the demonstration of anthrax organisms.

6. It must be left to further investigation to modify the technic of the Ascoli test, in order that it may be possible by some means to limit positive reactions to those cases in which anthrax is actually present.

Veterinary Science in Relation to Public Health, and Milk[32]

It is only by means of veterinary regulations that the production of milk can be guarded against serious disturbances due to the occurrence of disease in the milk-producing animals, and to ensure the supply of a sound, harmless, and satisfactory milk. The most important diseases which endanger the supply of milk are foot-and-mouth disease, tuberculosis, contagious abortion, and yellow. The latter is becoming more and more a source of anxiety in dairies. The suppression of these diseases is in the interest of the improvement of milk production. Veterinary regulations also exclude from milk production animals suffering from diseases which are transmissible to man, such as anthrax, rabies, cow-pox, diseases caused by bacteria of the paratyphoid-enteritis group, and localized diseases of the udder.

The detection of milk affected by certain kinds of feeding and medicinal treatment is also a matter for the veterinary control of milk production. The provision of clean milk resulting from the proper construction of cowhouses, attention to cleaning the udder, careful removal of the milk from the cowhouse, straining, cooling, and maintaining the milk at a low temperature until the time of sale are all matters which come under this heading. The "slogan" of the milk trade, "Sound milk can be obtained only from healthy cows," can be fulfilled only by official regulation of the veterinary control of milk. In England the Milk Order of 1926 achieves this, and the Milk Laws in Germany aim at the same result.

All dairies must be under veterinary control. Comprehensive general principles to be applied by the supervising veterinary surgeons and dairy owners should be drawn up, as is done in Denmark, and these should be such as to satisfy the demands of public health. At the same time the agricultural side of the matter must be kept in mind; hygiene is also a matter requiring constant attention in this connection.

The disease of milk cows, feeding, and medicinal treatment, with which the veterinary surgeon must be in constant touch, have been referred to under "Milk Production." Milk from cows affected with tubercular mastitis or other forms of open tuberculosis is to be considered as a possible source of danger to human health.

In Germany milk from cows suffering from streptococcic mastitis is not held to be prejudicial to the health of man, but when it contains pus it is unfit for sale. In the United States forms of mastitis occur which render the milk dangerous, and may cause epidemics among human beings who have drunk the milk in the raw state.

Veterinary control of dairies is supplemented by laboratory control. This plays a part parallel to that performed in connection with the examination of meat and meat inspection. The laboratory work includes the determination of the bacterial content, to ascertain the freshness and degree of cleanness of milk, and to detect pathogenic organisms and cellular matter by bacteriological and histological examinations of milk

[32] Beziehungen der Veterinärwissenschaft zur Offentlichen Gesundheitspflege, Insbesondere zur Erzeugung von Milch und zum Verkehr mit Diesem Erzeugnis; by Ministerialrat Prof. Dr. R. von Ostertag, Stuttgart, Germany. Presented at the Eleventh International Veterinary Congress, London, 1930.

sediments. The findings which result from these examinations furnish grounds for the examination of the animals in the dairies and also afford a check upon the efficiency of the dairy inspection.

Veterinary Science in Relation to Public Health and Meat[33]

The duties of veterinary medicine are not limited to the animal. Veterinary science has far more important relationships with public health administration on account of the occurrence in animals of diseases which are transmissible to man (Zoonosen). The control of the production and sale of meat are also important duties of veterinary science both for the prevention of infection of human beings and on other grounds as well.

The production of meat would be a simple factor if the agriculturalists producing it had only healthy animals to deal with. Production is, however, rendered far more difficult by the occurrence of disease in animals suitable for slaughter.

The most important of these are the diseases which render the production of meat uncertain. The control and suppression of these diseases is an important weapon in the improvement of the production of meat, the daily food of man. Control of disease must be effected by thorough protection against the introduction of disease from other countries, and suitable sanitary police regulations for the prompt suppression of outbreaks within the country.

It is the pride of the veterinary police in advanced countries that they have brought the production of meat up to a high and constant level by the control and suppression of the old animal plagues (cattle plague, pleuro-pneumonia, sheep pox, and to some extent sheep scab). Anthrax and black quarter, and the diseases which are of importance in the poultry trade (fowl cholera, fowl plague, and fowl pox), are also controlled to a considerable extent.

[33] Beziehungen der Veterinärwissenschaft zur Offentlichen Gesundheitspflege, Insbesondere zur Erzeugung von Fleisch und zum Verkehr mit Diesem Erzeugnis; by Ministerialrat Prof. Dr. R. von Ostertag, Stuttgart, Germany. Presented at the Eleventh International Veterinary Congress, London, 1930.

The stamping out of anthrax requires international agreement against the importation of animal products such as hides, hair, bristles, bones and bone meal, infected with anthrax, from all countries exporting such materials.

Factors of the greatest importance as regards the production of meat are foot-and-mouth disease which reduces the meat and milk value of every infected animal by at least 50 to 100 Reichsmark, hog cholera, and tuberculosis.

Foot-and-mouth disease has been stamped out in the United States and in England by resorting to slaughter. In other countries important progress has been made by the use of Loeffler-Waldmann serum.

In places where tuberculosis is of rare occurrence, its control has been effected by the use of tuberculin. In countries where the disease occurs more extensively the method in most general use is to fight against the open, dangerous forms of tuberculosis. This method has had good results in Germany.

Further investigation is necessary in order to improve upon the results obtained hitherto in connection with hog cholera.

Apart from veterinary police regulations, veterinary science has important connections with the production of meat through the medium of the hygienic control of diseases associated with breeding, those caused by animal parasites, and the avitaminoses. Another duty is the laying down of basic rations and the determination of the most suitable kinds, breeds, and ages of animals for meat production.

The supervision of the sale of meat is a purely veterinary duty. This deals with the detection of animal diseases which are transmissible by ingestion to man, or which render the meat unsuitable in some other way for human consumption. The supervision of the sale of meat is associated with veterinary inspection of animals for slaughter and of meat, and also with the veterinary control of food stuffs.

The inspection of animals for slaughter and of meat obviously form the first line of defence of the human subject against the dangerous animal parasites, anthrax,

rabies, glanders, Malta fever, tuberculosis and the diseases causing meat poisoning.

Uniform methods of examining animals and meat is ensured by obligatory regulations regarding the examination of animals before and after slaughter, the transport of animals, and the erection of public slaughterhouses, at least in the larger communities.

The examination of animals and meat must be supplemented by the veterinary control of foodstuffs, which includes the detection of unauthorized preservatives and of adulterations, and also of game, birds, fish, amphibia, etc.

The remarkable results which have been obtained in connection with the control of diseases which are transmissible from animals to man, and particularly of *Taenia saginata* and *Taenia solium, Cysticercus cellulosae, Trichinella spiralis,* and other diseases, including meat poisoning shows the importance of veterinary control in the meat trade.

The Principles of a Meat Inspection Law[34]

Meat inspection and meat hygiene must be founded on a legal basis: in principle they must be general and applicable to all slaughter-animals. Slaughtering for home consumption may form an exception, however, under very strict limitations.

The inspection of fish, poultry and game requires special measures.

The law can be executed by the municipalities or by the government. The inspection, however, must be done over the whole country in the same manner, according to the same rules.

The supervision of this should be a government task and be done by veterinary experts. The leader of this service should be the direct adviser of the minister concerned.

The inspection should be allocated to veterinarians, and they may be assisted by non-veterinarians who have been specially educated for this task in accordance with government direction. These last-mentioned officials can render excellent services for control and for tracing.

It is desirable that the inspecting veterinarians should not be allowed to practice.

Provisions are necessary to enforce proper execution of legal regulations.

It is of importance that the administrative regulations regarding inspection, and all that pertains to inspection should be prescribed by the law.

Special attention should be paid to animals that have died or been killed in emergency.

For sanitary reasons, the decisive destruction of condemned meat is of manifest importance both for human and animal life. It is advisable to convert the condemned meat into valuable by-products.

Good hygienic conditions must be prescribed for all other trade establishments in which meat or offal can be kept in stock or can be prepared, as well as for the transport and handling of meat.

The establishment of public slaughterhouses must be encouraged.

Prescriptions regarding the preserving and the preparing of meat should not be wanting.

Humane slaughtering should be obligatory.

Meat should be inspected on importation; the governments should allow all meat to be imported without the organs, after mutual acknowledgment.

Meat inspection must become international with regulations built up on a scientific basis.

As a foundation for a meat inspection law, principles based on veterinary science must be chosen. In prescribing the principles of inspection, bacteriological examination should be included. Using this examination as an aid, when judging meat which does not show important alterations, one is able to serve both hygiene and economy, two interests that a good meat inspection law must take into consideration as much as possible. Antemortem inspection is necessary.

[34] On the Principles (both Administrative and Scientific) of a Meat-Inspection Law, also with Reference to International Conditions; by Dr. H. C. L. E. Berger, Director of the State Veterinary Services and Chief Veterinary Officer of Health, The Hague, and Dr. H. S. Frenkel, Director of the Veterinary Division of the Central State Laboratory of Public Health, Utrecht, Netherlands. Presented at the Eleventh International Veterinary Congress, London, 1930.

Veterinary Science in Relation to Public Health[35]

The report submits a general résumé of the development of milk legislation and of the existing milk laws in Great Britain. The control and prevention of animal disease is vested in the Ministry of Agriculture and is under the direction of state veterinary officers, but questions referring to animal disease in relation to human health are dealt with by the State Departments of Health, which do not employ a veterinary surgeon. There is no government veterinary public health service and the veterinary officer only enters the sphere of public health in the local administration of towns and county districts.

Milk legislation is not uniform. England and Scotland have separate milk Acts, which are administered with considerable divergence by local authorities under the direction of the State Departments of Health. The country districts take their responsibilities less seriously than the towns and cities.

The field work of milk inspection deals with (1) dairy stock and the premises of producers, which is the sphere of the veterinary public health officer; (2) distribution and sale, devolving on the medical officer or sanitary officer. This dual control is unsatisfactory.

It was not until 1899 that the veterinary surgeon secured a legally recognized place in general milk legislation, and then only in respect of tubercular disease of the udders of cows.

The present milk acts applicable to England and Scotland did not come into force till 1925, though in 1922, an amending act providing for the official grading of milk, became immediately operative.

England and Wales

The Milk and Dairies (Consolidation) Act provides for the appointment of veterinary officers; and the sampling of milk for bacteriological and other examinations. The sale for human use of milk from cows giving tuberculous milk, suffering from tuberculous emaciation, acute mastitis, and other diseases, is prohibited. Sanitary supervision of the production and distribution of milk and of the health of dairy workers is provided for.

Eight or nine counties have appointed whole-time veterinary officers and in some counties a panel of practicing veterinary surgeons acting as part-time officers has been formed. There are, nevertheless, intensive dairying districts where no systematic inspections are carried out, and where action is only undertaken on the initiative of the towns in respect of samples of milk found, on delivery, to be injurious to human health.

Scotland

The Milk and Dairies (Scotland) Act also provides for the appointment of veterinary officers and whole-time or part-time officers have been appointed by nearly every local authority in Scotland. As a result, the cattle in dairies are inspected once at least in each year, and in many places oftener.

The Tuberculosis Order is complementary to the Milk Acts, and subject to compensation, gives power to slaughter cows giving tuberculous milk or affected with tuberculosis of the udder, bovines suffering from tuberculous emaciation or advanced clinical tuberculosis. The Order, primarily a public health measure, is not intended as a means of controlling bovine tuberculosis. In 1928, out of 16,967 cattle slaughtered under the Order, at least 2,632 were known to be milk and udder cases.

The milk acts are leading to an extensive survey of dairy premises and to progress in raising the standard of housing for dairy stock. In combination with clean milk competitions and other voluntary influences, they have also been productive of improvements in the hygienic collection and distribution of milk.

The grading of milk under the Milk (Special Designations) Order, is partial only in its application. The Order recognizes four grades of milk: (1) Certified, (2) Grade A (Tuberculin Tested), (3) Grade A and (4) Pasteurized. The first

[35] Veterinary Science in Relation to Public Health, with Special Reference to the Production and Distribution of Milk; by Arthur Gofton, F.R.C.V.S., Edinburgh, Scotland. Presented at the Eleventh International Veterinary Congress, London, 1930.

two are the produce of tubercule-free cows. Pasteurized milk must be held at 145-150 degrees F. for 30 minutes. Retarders have now almost entirely displaced plant for "flash" pasteurization. From 45% to 90% of the total daily supplies of certain representative cities is pasteurized.

Licensed producers in Scotland are able to maintain the fat standard of 3.5% required for Certified, Grade A (T.T.) and Grade A milks, and most samples are found to be well below the maximum bacterial standards permitted. The most common failure is in respect of the coliform test.

Progress in the establishment of tubercle-free herds has been very slow. In 1929, there were only 447 licensed tubercle-free herds in Great Britain, in addition to an unknown number of non-licensed herds. The slow progress is in part attributable to lack of public support.

The fact is clear, however, that, in proportion to the total requirements of Great Britain, the daily production of milk from tubercle-free herds is scarcely significant. It is also clear that such progress as has been made has been painfully slow. There are several reasons for this. It is only in recent years that stockowners, in any numbers, have commenced seriously to consider the possibility of clearing their herds of tuberculosis. There can be no doubt that the Milk (Special Designations) Order has been one factor turning their thoughts in this direction. Again, owners who have cleared their herds and obtained a license for the sale of tubercle-free milk have experienced difficulty in finding a market for their milk at a price which gives an adequate return on the extra costs incurred. And, further, the movement, until recently, received small encouragement from the local authorities who are responsible for administration of the milk grading orders, and who own and maintain, out of public funds, hospital and similar institutions accommodating a large percentage of sick children. Latterly, however, public authorities in increasing numbers are either producing tubercle-free milk for their hospitals or they are purchasing it in increasing quantities in the open market.

Veterinary Science and Milk Hygiene[36]

The collaboration of veterinary surgeons in the practice of milk hygiene can be divided into two main parts. The first may be called specifically veterinary, and includes the study and combating of various diseases which can be transmitted to man by milk (viz., tuberculosis, undulant fever, paratyphoid fever), or can make the milk unfit for human consumption (mastitis, etc.).

The second part includes the advancement of the production of first grade milk, the study of the technical problems concerning the handling of milk, and practical milk-control.

There are experts in other branches able to tackle these problems, but the veterinarian is at an advantage for this work. His knowledge of the conditions at the farm will prevent him giving orders concerning milk which are at cross purposes with the normal keeping of cows and farm-labor. His knowledge of nutrition will determine his choice of food for the cows, in order to ensure the production of milk of the desired composition and nutritive value. The veterinarian knows how to deal with the distribution of milking-times throughout the day, and is in a position to advise as to the supply of fresh cows over the whole year. His zootechnical instruction enables him to select the best milking cows and to decide such matters as the keeping or discarding of new-born calves.

The profound teaching of bacteriology at most of the veterinary high schools enables the veterinary surgeon to investigate the bacteriological condition of milk and the effect of various influences thereupon.

Large numbers of bacteria, including *B. coli*, in milk should be avoided, because even pasteurization is not an efficient method for destroying the unfavorable properties of such milk. Milk should be produced under such conditions that no proliferation of bacteria is possible. In this respect the task of the veterinarian is twofold. Firstly, he can indicate to the farmer and to the dairyman means which are simple and efficient

[36] Veterinary Science and Milk Hygiene; by Professor C. F. Van Oijen, Faculteit der Veeartsenijkunde, Rijks-Universiteit te Utrecht, Netherlands. Presented at the Eleventh International Veterinary Congress, London, 1930.

under normal farm conditions, by which multiplication of bacteria can be avoided. Secondly, he is in a position to recommend rapid and efficient methods of controlling the number of bacteria in milk and for the detection of undesirable types.

Milk with a low bacterial count may be produced on almost every farm. The main principles are: thorough cleansing of dairy utensils and sterilization by means of steam or hot air, or by rinsing with a disinfectant liquid. Hand milking and machine milking can give equally satisfactory results, provided the milking machine is thoroughly cleansed and sterilized. The improving supplies of water and of electric light and power in many countries make it possible for many farmers to join this movement. Veterinarians must be the promoters of these ideas and must teach the farmers the details of how to produce clean milk.

Milk cooled below 10° C. (50° F.) can be transported practically everywhere without any increase in the number of bacteria.

Even under tropical conditions such milk may be kept or transported for several hours, without showing an increase in the number of bacteria.

In temperate countries cooling to about 14° C. (57.2° F.) can be done very easily on any farm on which artesian water is available, but for the cooling below 10° C. a refrigerator of some kind is necessary. The technical perfection which has now been reached by automatic refrigerators is in favor of their use on farms, but as stated previously, it is not necessary to cool to this temperature immediately after milking. There is ample time to transport the milk to a delivery-station in the neighborhood, where the cooling can be done on a wholesale scale and the cost per gallon reduced to a trifling figure. Milk cooled to about 6° C. (42.8° F.) is in excellent condition for railway or motor transport, even over long distances.

Veterinary surgeons should make use of arguments such as these in order to promote the proper sterilizing of milk and dairy utensils and the delivery of milk at a refrigeration center. At such a center veterinarians may be entrusted with the laboratory control of the milk delivered, and the center may also be used for auxiliary work, such as the control of mastitis, tuberculosis, and other diseases, but these subjects are not included in the scope of this article.

Although the qualitative bacteriological test is acknowledged to be the only suitable method for testing the cleanliness of milk, there was until recently no method which reached practical requirements, viz., a high degree of accuracy and quick reading of results.

These requirements are attained in the "small plate method" of Frost. I have had this method tested on a large scale in my laboratory, and have given reports of our experiences before different meetings. Visitors to my laboratory from many countries, have informed me that they were not conversant with the method, and when the details have been explained to them they have acknowledged its usefulness. It is advantageous, therefore, to give a short description of the method.

On a sterile slide, on which are marked two rectangles, each measuring 5 sq. cm., there is placed in each rectangle a mixture of 1/20cc of milk and 1/20cc of liquid agar, the slide at the time lying on a table heated to 45° C. (113° F.). The mixture, which should not solidify too quickly, is spread evenly over the rectangle with a platinum loop, so that every square mm. contains 0.0001cc of milk. In this way every colony growing per square mm. is indicative of 10,000 bacteria per cc. milk. After cooling the agar under a glass bell the slide is put in a specially devised damp incubator for 16 hours at a temperature of 28° C. (82.4° F.). The preparation is then fixed by drying for a few minutes at 95° C. (203° F.) and is subsequently stained with carbol thionin and finally washed in slowly running water. After drying, the number of colonies may be counted. To this end the slide is placed under the microscope and the preparation is enclosed by a cover glass, which is provided on its lower surface with a scale showing square mm. The colonies in a number of fields of one square mm. each, regularly

distributed over the whole preparation, are now counted. After calculating the average number per field and multiplying by 10,000, the result shows the number of bacteria per cc.

The advantage of this method is that when important differences in the numbers of bacteria are met with, one can apply next day to the manager of the farm to know where the fault lies. It is then often possible to trace irregularities in the handling of the milk. This quick working method is a greater impetus to the farmers to be on their guard than an inspection which reports its results more than a week after the test.

Bacillary White Diarrhea and Fowl Typhoid[37]

One cannot deny the relationship of the causal agents of white diarrhea and fowl typhoid and the resemblance between the diseases for which they are responsible, but it has seemed preferable to continue to distinguish between the two diseases. Bacillary white diarrhea and fowl typhoid are only a special case of the typho-colon group, in which the distinctions are never well marked.

From the systematic point of view the two diseases may be grouped under the common designation of typhoid, while continuing to distinguish fowl typhoid properly so-called, and bacillary white diarrhea.

Hereditary infection (transmission by the egg), plays an essential part in the spread of bacillary white diarrhea; the other methods of infection and propagation, particularly in adults, are only of secondary importance in hens, and of still less importance in cocks.

It is beyond doubt that serum diagnosis by agglutination is the method of choice as a basis for prevention. In the absence of special organizations or the help of associations (*e.g.*, syndicates, governments), the diagnostic inoculation of pullorin enables the control to be directed, and thus limits the number of agglutination tests.

With regard to the practice of the serum diagnosis, it is essential that general rules are adopted, and that the conditions of the reaction are fixed by agreement, choice and preparation of antigens, dilution of the antigen and of the serum, titres of agglutination, etc.

On account of the rapidity with which the result would be obtained, the study of the bacteriophage deserves to be pursued.

Vaccination against fowl typhoid, in spite of its imperfections and its failures, even carried out with stock vaccines is, in the majority of cases, an effective weapon in the struggle against the disease. Strict attention must be paid to the observation of hygienic measures which must be adopted as a general rule in poultry breeding.

Fowl Typhoid and Bacillary White Diarrhea[38]

Both fowl typhoid and bacillary white diarrhea represent diseases which, though autochthonous not only in North America, but also in Europe, have but recently attained an eminent economical importance. Up to recent times it was generally accepted that fowl typhoid and bacillary white diarrhea are also from an etiological standpoint two distinct diseases, the first being caused by *Bacterium gallinarum*, Klein, the latter by *Bacterium pullorum*, Rettger.

Bacteriological and serological investigations which at the same time, but independently from each other, have been carried out by the writer and by Klimmer and Haupt, led to the recognition of the fact that *B. pullorum*, while not representing a well defined, distinct species, may be regarded as but an inconstant variety of the *B. gallinarum* (*Bacterium gallinarum var. pullorum*). Fowl typhoid and bacillary white diarrhea are, therefore, two different manifestations of an etiologically uniform disease, the differences being due to variations in age of the animals involved. Epidemiological observations are not in contradiction with this bacteriological statement,

[37] Diarrhée Blanche Bacillaire et Typhose Aviaire; by M. le Professor Dr. L. Panisset, Ecole Nationale Vétérinaire, Alfort (Seine), France. Presented at the Eleventh International Veterinary Congress, London, 1930.

[38] Hühnertyphus und Bakterielle Küchenruhr; by Dr. R. Manninger; o.o. Professor an der Königl. Ung. Tierärzlichen Hochschule und Direktor des Staatlichen Veterinärhygienischen Instituts in Budapest, Hungary. Presented at the Eleventh International Veterinary Congress, 1930.

for it may be assumed that losses among adult birds are, in the majority of cases, presumably due to pathological changes acquired during young age and originate probably, but in a minor part of the cases, from infections acquired during the adult stage.

The disease may doubtless be transmitted by germinative heredity. In this respect the most important role is played by female animals as carriers, for the *B. gallinarum* occurs more or less frequently in the ova contained by the ovary of hens which suffered from the disease as baby chicks or acquired the infection at a later stage. The role played by cocks with respect to germinative heredity is but unimportant when contrasted with that of the female birds.

Though the pathologic effect of *B. gallinarum* may experimentally be demonstrated, there seems to be no doubt that the pathogenesis of the disease caused by this microorganism, as well as its spreading as an epizootic, is more or less influenced by a number of occasional causative factors, depending largely on unfavorable environmental hygienic conditions which may partly lower the natural resistance of the animals, partly increase the possibilities of the infection. While the infection may take place at any age by droppings of animals showing symptoms of the disease (septic enteritis), this possibility is considerably reduced in the case of animals the infection of which may be ascertained by blood testing only. The eggs of such hens, however, if fed to healthy animals, may also transmit the infection.

The diagnosis of fowl typhoid and bacillary white diarrhea depends largely on the bacteriological examination, for no symptoms or pathological changes are known to be absolutely pathognumonic of the disease.

No benefit whatever towards the control of the disease can be obtained by the use of biological products; moreover, the injection of vaccines renders blood-testing for a certain period unfeasible. A very efficient method of control consists, apart from the strict observation of general hygienic measures, in careful elimination and killing of the reactors.

Of the methods recommended for the detection of the infected animals, the allergic test with the "pullorin" cannot be regarded, at present, as a method securing reliable results. On the contrary, the agglutination test, if performed with due consideration of some sources of possible failures, renders quite satisfactory results. Failures are partly of a technical nature, and may partly be due to the quantitative variation of antibodies in the blood of infected animals For this special reason a prompt and reliable eradication of the disease from a flock largely depends on repeated blood-testing.

At the present time it seems unnecessary to schedule fowl typhoid and bacillary white diarrhea among diseases of obligatory notification; it would, however, be advantageous to establish uniform state organizations in order to reduce the incidence of this disease. In this respect the establishment of a state supervision extended free of charge to any farm providing the owners would subject their flocks to the sanitary measures as proposed by the veterinary officials seems to be advisable.

Bacillary White Diarrhea[39]

This name is an unpleasant, inadequate and misleading description of the disease caused by *Bacillus pullorum*. The lay mind seizes on the word "diarrhea" as the essential feature of the disease and too often satisfies itself that, if this symptom is lacking, the losses are due to other causes. It is well known, of course, that affected chicks often show no diarrhea and that this symptom is infrequent in adult "carrier" birds. "Pullorum disease," while not an informative name, has the merit of being non-committal regarding the symptoms exhibited and is to be preferred to the existing name for the disease.

The disease has been reported in ordinary fowl, turkeys, ducks, sparrows and pheasants. Transmission of infection to man has not been proved, but has occurred in rabbits, guinea pigs and kittens.

[39] Bacillary White Diarrhoea and Fowl Typhoid; by Capt. J. P. Rice, B.Sc., M.R.C.V.S., Head of Animal Diseases Division, Ministry of Agriculture, Government of Northern Ireland, Belfast, Ireland. Presented at the Eleventh International Veterinary Congress, London, 1930.

Chicks hatched under hens enjoy no special immunity. The small unit is probably responsible for the comparative infrequency of the disease in hen-hatched chicks. The experiments of Roberts and Card (1926) indicate the possibility of developing resistant breeds.

Apart from the intervention of the male bird, the most likely methods of infection in adults are by egg-eating and through the cloaca while in the nest. The disease has not been shown to pass from males to females or females to males.

Odd deaths in a flock frequently occur from exacerbation of the ovarian disease. Birds commonly recover, and allowance should be made for this fact when very valuable fowls are concerned. Adult birds which die from pullorum disease often show lesions resembling those seen in fowl typhoid.

The only practical method of eradicating bacillary white diarrhea is the agglutination test. Its value should be judged by the great success it has gained in the field, and not by the discrepancies disclosed in the laboratory. Any standard test should err on the side of safety, favoring the flock as a whole and not individual birds. Any degree of agglutination in a 1 in 25 dilution is suggested as a positive reaction.

The necessity for cleanliness in obtaining blood samples is emphasized. No testing work should be undertaken which cannot be properly carried out and supervised.

The campaign against pullorum disease is as much a matter of teaching the poultry industry the elements of hygiene as it is of applying specific measures.

The evidence which has accumulated in recent years suggests that Klein's bacillus is a variant of *B. pullorum*. The reporter submits that fowl typhoid and bacillary white diarrhea should be regarded as merely different forms of the same disease.

Fowl typhoid may attack chicks in an acute form and adults in a chronic form. Transmission of the disease through the egg has not been proved.

Diagnosis in Chicks

Bacteriological examination is the only reliable method of diagnosis for pullorum disease in chicks. Ordinary agar cultures are sown from the liver and from any lesions or yolk material present. Brilliant green agar plates are inoculated with intestinal contents. Stained smears of pullorum-like colonies should invariably be made, as streptococci which grow like *B. pullorum* are sometimes encountered. Final identification is based on fermentation tests.

Evidence which arouses suspicion of the disease is a high mortality occurring during the first two or three weeks after hatching. The deaths are distributed over several days, whereas losses from mismanagement tend to occur during a short period.

Bacillary white diarrhea can be distinguished from Klein disease of chicks by the sugar reactions of the organism isolated and from coccidiosis by microscopical examination of the ceca and duodenum for the causal protozoan.

Prevention

The problem of pullorum disease is the problem of artificial methods, with mammoth incubators giving place to still more mammoth incubators, with battery brooders giving place to still larger battery brooders, with the poultry industry striving to compensate for its gigantic losses by greater mass production of chicks.

Some have suggested that the solution of the bacillary white diarrhea problem lies in a return to the broody hen. While the employment of small units is a valuable means of controlling a contagious disease, consideration must be given to economy of working. A compromise has to be made between the extra cost of managing small units and the increased risks of disease in large units. The size of the unit should vary inversely with the proportion of "carriers" in the flock. This means that on a particular farm the unit may be enlarged as testing progresses.

The keystone of prevention is the agglutination test, but it is only a keystone, which may collapse unless strongly supported by other measures. The necessity for supplementary precautions is not sufficiently recognized by the poultry industry. The farmer often does not realize, for in-

stance, that infection can be easily carried on the person of the attendant or that a crack which has escaped disinfection may harbor enough infection to destroy a hatch. These facts appear so obvious to veterinarians that they credit poultry-keepers with similar knowledge of the dangers. The campaign against pullorum disease is as much a matter of teaching the industry the elements of hygiene as it is of applying specific measures.

Fowl Typhoid and Bacillary White Diarrhea[40]

Fowl typhoid and bacillary white diarrhea are the two most important diseases of the avian species caused by organisms of the intermediate group. The causative organism of fowl typhoid was first isolated by Klein in 1889, but the disease, as well as the organism, was later described under a variety of names. Although *Bact. gallinarum,* the cause of fowl typhoid, has many features in common with *Bact. pullorum,* the cause of bacillary white diarrhea, the two remain as distinct species. Whereas *Bact. gallinarum* produces acid in maltose, dextrin and dulcite, *Bact. pullorum* fails to attack these. Furthermore, *Bact. pullorum* usually produces gas in some carbohydrate media, a feature never observed in the case of the typhoid organism.

Although fowl typhoid seems to attack adult birds by preference, it is occasionally seen in baby chicks. In this case the infection is undoubtedly contracted through the egg in many instances. This for the reason that the organism has been found to cause a localized infection in the ovaries of survivors of infection, in the yolk of the egg, and finally in the unabsorbed yolk of very young chicks dead of the disease. Outbreaks of the disease in chicks not exposed to any other known source of infection afford striking evidence of transmission through the egg.

The survival of infection on a farm from year to year is accounted for by assuming that certain survivors of infection continue to harbor the organism in the intestinal tract. That infection does not survive in the soil is evidenced by the fact that in soil of pH 7.0 the organism remains viable only for a period of about twelve to sixteen weeks, for a correspondingly shorter time in more acid soils, and probably not at all in soils below pH 6.2. On this basis, the prevention of typhoid may be possible by rearing young stock on clean ground apart from adult survivors of infection.

Bact. pullorum, the cause of bacillary white diarrhea or pullorum disease, was first isolated by Rettger in 1899. He and his co-workers established that the infection was transmitted through the egg, and that the control of the disease depended upon the detection and removal of carriers of infection. The agglutination test proposed by Jones in 1910 has come into general use as a means of detecting infected birds. Although other tests have been proposed since 1910, none of them have proved to be as accurate as the agglutination test.

In New Jersey a single dilution of blood serum is used in making the test, that is, 3cc of antigen are added to 0.5cc of serum to give a 1 to 60 dilution. An apparatus for pipetting serum has been devised so that one operator may transfer up to 600 samples an hour. By means of another apparatus, doses of antigen are accurately and rapidly delivered. The use of such apparatus makes it possible to set up a large number of tests in a comparatively short period, so that the cost of this phase of eradication work is materially reduced.

Repeated annual testing of a flock results in the infection being reduced by about one-half each year until the disease is completely eradicated. When the percentage of infection is high on the original test, it is better to dispose of the flock and start another from a source known to be free of the disease. Unless importations are made from the outside, the disease does not reappear in a flock from which it has been eradicated. However, the disease has been found in wild birds recently. It has not been observed to spread from this source, but it seems possible that it may do so.

[40] Fowl Typhoid and Bacillary White Diarrhoea; by F. R. Beaudette, D.V.M., New Jersey Agricultural Experiment Station, New Brunswick, New Jersey. Presented at the Eleventh International Veterinary Congress, London, 1930.

Immunization Against Fowl Plague[41]

Two methods are available for the production of immunity against fowl plague: serum-therapy and vaccination.

1. *Serum-therapy.*—It is an easy matter to prepare specific serum by hyperimmunizing fowl which have either recovered from natural infection or have been infected experimentally with blood or other virulent material. While this method is theoretically possible, it has scarcely been applied in practice on account of the difficulty of preparing large quantities of serum.

2. *Vaccination.*—A great variety of methods have been tested for this purpose, employing living, modified or dead virus.

(*a*) Vaccination with unaltered virus. This includes attempts involving the use of sub-lethal doses, an infection by the ingestion of infective material. Little success has been achieved.

(*b*) Vaccination by modified virus. To effect this, virus attenuated either by heat or by desiccation by caustic potash has been employed. As in the Pasteurian method as applied to rabies, the brains are suspended above caustic potash for a varying length of time.

Generally speaking, this method yields very mediocre results, and it is still in the experimental stage.

(*c*) Vaccination with dead virus. A large number of investigations have been carried out, principally by Pfenniger, with virus sterilized either by heat or by chemical agents. Basing his experiments upon the essential fact that the virus occurs in the central nervous system, he has attempted to treat the brains first with carbolic acid and then with ether.

His conclusions show that vaccination with virus thus modified is borne comparatively well, but the immunity conferred is too weak to resist a test with virulent material 40 days later. A new method devised by Staub, of the Pasteur Institute, Paris, which appears to give better results in vaccination by means of formolized infective spleen pulp. The author, however, admits that the immunity acquired is of short duration, and should be reinforced by an inoculation with virulent material within eight days of the vaccination.

Todd, after testing the vaccination with formolized spleen pulp without success, suggests another method in which carbolic acid and glycerine appear. This author claims to have obtained good results because the animals tested resist infection with millions of lethal doses of infective material.

The recent publications of Doyle on the one hand and Lagrange on the other, regarding the occurrence of pseudo-fowl plague in England and in Egypt, do not help to clear up the problem, but they are of great interest as indicating the various types of these diseases.

Until something new makes its appearance we are in favor of Staub's method, which is remarkable both for its simplicity and its practical economy.

Fowl Pox[42]

Fowl pox is a contagious disease due to a filter-passing virus, characterized by eruptive lesions on the unfeathered parts of the head, by yellow cheesy membranes in the mouth, and by an oculo-nasal discharge. Any one or a combination of these lesions may be present.

It has been definitely proved that the epithelial growths on the comb and the yellow cheesy membranes in the mouth are caused by the same filterable virus.

It is suggested, therefore, that in order to eliminate the existing confusion in the nomenclature of the disease, the use of the terms "roup" and "avian diphtheria" should be discontinued.

Every case of disease caused by fowl pox virus, irrespective of the symptoms manifested or the lesions induced, should be called fowl pox.

The disease is very contagious, the principal method of propagation being probably through wound infection. It is highly

[41] Immunisation Contre la Peste Aviaire; by Dr. C. Truche, Chef de Laboratoire à l'Institute Pasteur, Paris, France. Presented at the Eleventh International Veterinary Congress, London, 1930.

[42] Fowl Pox; by Captain T. M. Doyle, F.R.C.V.S., D.V.S.M., Research Officers, Veterinary Laboratory, Ministry of Agriculture, Weybridge, England. Presented at the Eleventh International Veterinary Congress, London, 1930.

probable that mosquitoes are an important factor in the dissemination of infection.

No evidence could be found of the existence of "carrier" fowls, and this is in agreement with the clinical history of outbreaks.

The viruses of fowl pox and vaccinia are immunologically distinct; while the viruses of fowl pox and pigeon pox are immunologically indistinguishable.

Although the viruses of fowl pox and pigeon pox are immunologically indistinguishable, they are in some respects, probably as the result of species adaptation, sharply differentiated. Two outstanding points of difference are the transmission by contact in cage experiments and the persistence of the virus in the internal organs of recovered birds.

In the present state of our knowledge caution should be exercised when studying fowl pox virus not to base experiments on conclusions arrived at from work on pigeons.

As fowl pox is a contagious disease, and as individual fowls are of relatively small value, it is advisable to kill those affected.

In spite of the vast amount of work which has been undertaken with the object of finding a safe and reliable vaccine, the results have until quite recently been unsatisfactory.

Dead virus confers no protection, and live virus, whether modified by physical or chemical means, is too unreliable and dangerous in its action to be of much practical value.

The introduction of pigeon pox virus as an immunizing agent appears to have solved this problem.

Investigations have shown that fowls inoculated with pigeon pox vaccine are solidly immunized against natural infection and partially protected against artificial infection, with fowl pox virus.

Immunity is fully established about the fourteenth day after inoculation.

Susceptible fowls do not contract infection when kept in contact with fowls exhibiting active pigeon pox lesions on the comb, mouth or skin.

The vaccine does not give rise to any constitutional disturbance, loss of condition, or as far as has been ascertained, interfere with egg production.

It has been definitely proved that in pigeon pox virus we possess a valuable agent for the protection of fowls against natural infection with fowl pox. And when employed in conjunction with hygienic measures it should bring about a rapid and marked reduction in the incidence of the disease.

Fowl-Pox and Coryza[43]

Vitamin A deficiency and infectious bronchitis in certain clinical aspects are similar to the diseases given in the title.

Avian diphtheria is etiologically identical to fowl-pox and the etiological agent is the filterable virus of fowl-pox. The lesions of fowl-pox are formed by the hyperplasia of epithelial cells which contain inclusion bodies. Goodpasture and Woodruff have succeeded in isolating the inclusion bodies from the epithelial cells and in producing typical fowl-pox by inoculating the skin of a fowl with a single inclusion body. The inclusion bodies are therefore believed to be true *virus bodies, i.e.,* minute colonies of the etiological agent.

It has been shown by Kligler, Muckenfuss, and Rivers that fowl-pox can be transmitted by mosquitoes. It is probable therefore that in some localities mosquitoes may be important agents in the transmission of the disease on farms and that other biting insects may be of importance in this regard.

Cutaneous vaccination with vaccine containing unattenuated virus has been found to be a satisfactory method for immunizing against fowl-pox by Johnson, Beach, Sawyer, Beaudette, and Stafseth and is now being extensively practiced on poultry farms.

Coryza has not been established as a specific infectious disease. Investigations by Pritchett, Beaudette, and Hughes have, however, shown that in many flocks the disease may be due to the localization in the nasal passages of infection with the fowl cholera organism. Stiles and Bunyea have reported favorable results in prevention and treatment of the disease from the use of a bacterin prepared from strains of *Staphy-*

[43] Fowl Pox and Coryza; by J. R. Beach, Division of Veterinary Science, University of California, Berkeley, Calif. Presented at the Eleventh International Veterinary Congress, London, 1930.

through wound infection. It is highly im-
lococcus aureus of avian origin.

Vitamin A deficiency and infectious bronchitis of fowls are diseases involving the upper respiratory tract which in some respects are similar to fowl-pox or coryza.

Movements of the Uterus in the Bovine[44]

In collaboration with Steinmetzer, Benesch has examined the uterine movements in the living bovine during the puerperal period, and has recorded the results by means of the kymograph, using Marey's tambour. The results obtained in 75 experiments carried out on 41 animals give the following results:

Immediately after parturition up to the end of the first day the uterus shows a series of contractions following each other in rapid succession and each lasting from 80 to 120 seconds.

During the second twenty-four hours after parturition the intervals between the contractions become irregular and last for 8 to 12 minutes, and there is distinct reduction in the strength of the contractions.

At 48 to 60 hours after parturition there is a complete disappearance of any marked contraction rhythm, and from 60 to 80 hours only a slight irritability of the uterus can be detected.

The clearly marked contractions disappear almost completely during the fourth day, and from this time onwards to the eighth day the only movements detectable are irregular undulations in the horns.

From the 8th day the curve takes the form of a straight line.

From a study of the processes following the administration of ecbolics or after epidural anæsthetization the author draws the following conclusions:—

Of the ecbolics known at the present time pituitary products are by far the most important. The effect of pituitary extracts, which no other known ecbolic can produce, depends upon the stage of involution and the manner in which it is given, and shows itself either as an acceleration and increase in the strength of the contractions which lasts for several hours or in an increase in the internal tonus.

A dose of 10cc is usually sufficient. During the first days, and up to the fifth day, after parturition it should be given either subcutaneously or epidurally, and after that intravenously.

Epidural injection is considered superior to subcutaneous or intravenous injection because the effect persists for a relatively longer time, and the rhythmic increase in the contractions becomes more apparent.

There can be no doubt that in cases of retention of the membranes recovery is assisted in a very marked manner by the administration of pituitary extract associated with ordinary local treatment.

The clinical observation that spontaneous contraction of the uterus is not disturbed by epidural anæsthetization is confirmed. The uterus is autonomous to the extent that under deep epidural anæsthesia a normal increase in the strength of the uterine contractions can be produced by epidural injection.

All other known ecbolics, and especially quinine, secale cornutum, extractum hydrastis canadensis, etc., are far inferior to pituitary extracts in the involution stages in bovines.

An incomparably inferior effect is produced by the internal, subcutaneous or epidural administration of quinine during the first two days after parturition to that produced by pituitary extract.

Secale cornutum and its compounds, which are generally considered the best drugs for the human subject during the post-partum period, are either quite without action or produce so slight an effect either by subcutaneous or epidural administration in cattle during the puerperal period that, as ecbolics during the involution stage or in retention of the afterbirth, their use should be abandoned.

[44] Die Graphische Darstellung der Normalen, der Medikamentell Verstärkten und der Abgeschwächten Uterus-Bewegung am Lebenden Rind im Involutionsstadium; by Prof. Dr. Franz Benesch, Direktor der Geburtshilflicken Klinik der Tierärztlichen Hochschule, Vienna, Austria. Presented at the Eleventh International Veterinary Congress, London, 1930.